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A Study of Estuarine Sportfishes in the Biloxi Marsh Complex, Louisiana

F-8 Completion Report

A Dingell-Johnson Project

BENNIE J. FONTENOT, JR., PROJECT LEADER
HOWARD E. ROGILLIO, ASST. PROJECT LEADER

LOUISIANA WILD LIFE
AND
FISHERIES COMMISSION
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1970

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

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ABSTRACT

This study, an investigation of estuarine sportfishes of the Biloxi Marsh Complex, presented to the sportsmen key factors in the habits and life histories of these fishes.

The family Scaienidae was the dominant family and contained the most sought-after species by sportsfishermen. The sheepshead, *Archosargus probatocephalus*, family sparidae, was also an important sportfish which existed abundantly in the study area.

Catch of the various scaienids and of the sheepshead was correlated to date, salinity, tidal condition and water temperature at time of capture. Food habits, spawning habits, movement data, and size distribution were also presented. A discussion of the other fishes captured concurred but was not as detailed.

Hydrological data presented in this study consisted of pH, free carbon dioxide, alkalinity, chlorinity, salinity, water temperature, tidal condition and turbidity.

This study was initiated July, 1960, lasted for eight years and terminated June, 1968.

A STUDY OF ESTUARINE SPORTFISHES IN THE BILOXI MARSH COMPLEX, LOUISIANA[1]

BENNIE J. FONTENOT, JR.[2]

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INTRODUCTION

This project was initiated July, 1960 as an investigation of estuarine sportfishes of the Biloxi Marsh Complex. The primary objective was to present to the sportfishermen key factors in the life history and habits of estuarine sportfishes. With this knowledge, the sportfishermen would better understand the fishes that they are attempting to capture resulting in more successful fishing trips. This objective was accomplished through fishery study techniques such as population sampling, tagging studies and food preference analyses. Results of population sampling were correlated to the date and to the hydrological conditions that existed at time of capture.

Another objective was to obtain documented data of fishes and hydrological conditions in order to predict and demonstrate the effect on them due to future channelization, land reclamation, increased pollution and other man-made alterations affecting this complex.

This project lasted for 8 years and terminated in June, 1968.

DESCRIPTION OF AREA

General

The Biloxi Marsh Complex, located along the coast of southeastern Louisiana, is bounded to the north by Lake Borgne, to the west by the Mississippi River Gulf Outlet, and to the south and east by the Breton and Chandeleur Sound Areas (Fig. 1).

The Biloxi Marsh consists of shallow, brackish, and

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[1] Contribution from Dingell-Johnson Project F-8, Louisiana

[2] Fisheries Biologist, Project Leader, Louisiana Wild Life and Fisheries Commission

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saline lakes and lagoons having an average depth generally ranging from two to four feet at mean normal tide level. These scattered open water areas are connected to each other by a maze of bayous and canals containing relatively deeper waters. The water bottoms were composed of mud, mussel shells, and detritus.

Temperature

Seasonal fluctuations in surface water temperatures occurred in the Biloxi Marsh Complex (Table 1). Those fluctuations were similar at all stations. The lowest temperature recorded was 5° C, January, 1963; the highest recorded was 35° C, July, 1962.

Salinity

Due to the influence of the newly constructed Mississippi River Gulf Outlet, there was an overall increase in salinity during the early part of the study at most stations until the new effects of the Outlet stabilized, after which, only the normal changes in salinity occurred due to variations of in-flowing and out-flowing waters.

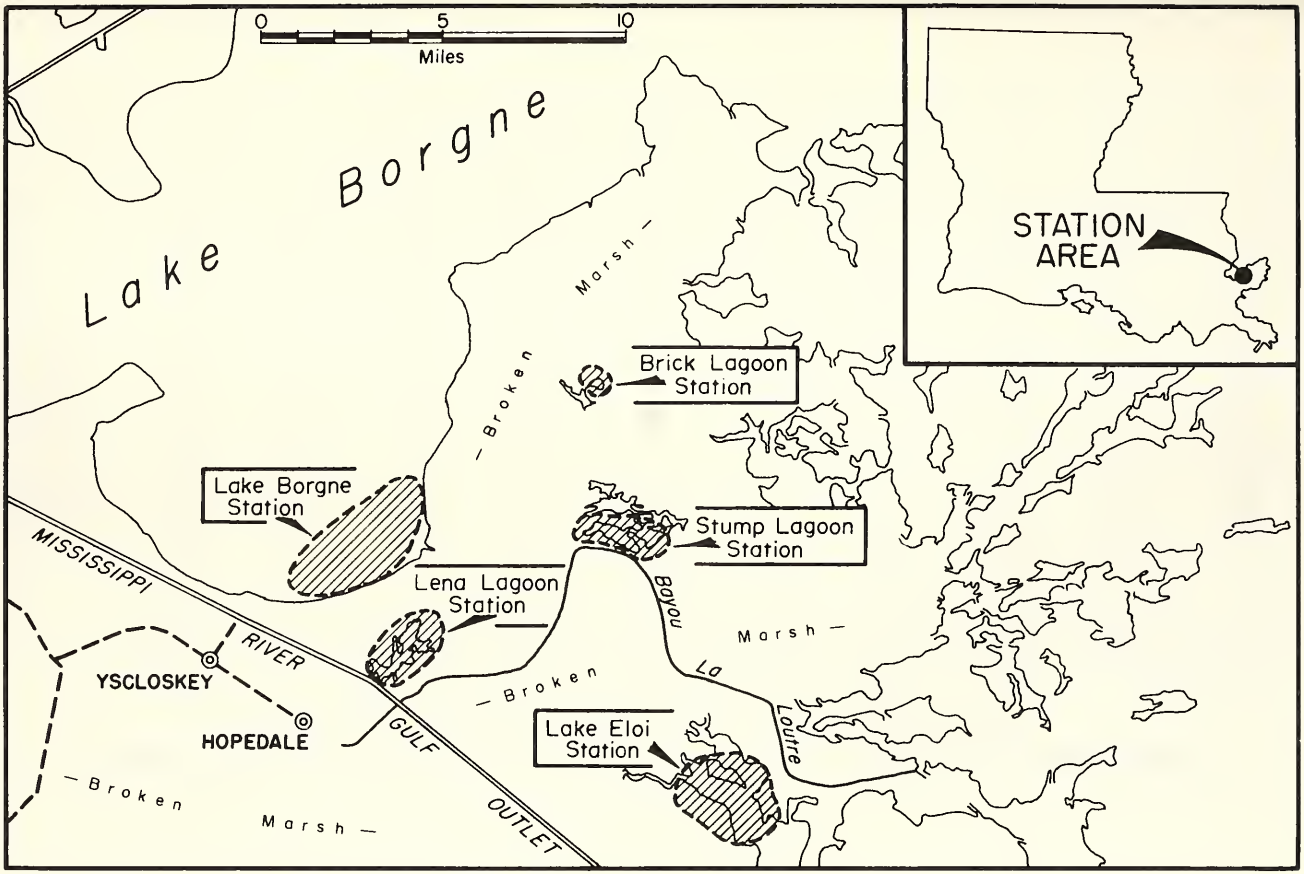


Figure 1 Location map of sampling stations.

Table 1
Surface Water Temperatures in Degrees Centigrade During the Various Months For Period July 1960 - June 1968 at Sampling Stations

	Lake Borgne		*Lena's Lagoon*		*Stump Lagoon*		*Brick Lagoon*		*Lake Eloi*	
	1960–64 Average	*1964–68 Average*	*1960–64 Average*	*1964–68 Average*	*1960–64 Average*	*1964–68 Average*	*1963–64 Average*	*1964–68 Average*	*1960–64 Average*	*1964–68 Average*
July	30	30	31	29	31	30	32	30	31	28
August	30	28	29	27	30	31	29	29	29	30
September	30	28	28	28	30	27		29	28	29
October	24	22	24	19	25	21		24	23	24
November	18	19	22	16		20		19	18	22
December	17	13	18	17	15	14		16		19
January	15	14	16	18	10	12	13	13	14	15
February	15	11	16	17	19	14	16	15	15	17
March	21	18	20	18	19	18	21	19	18	19
April	23	23	21	24	23	23	26	23	21	22
May	28	25	26	26	26	25	27	25	27	27
June	28	29	30	30	2–	29		29	27	29

During 1960-61, the average salinity for Lake Borgne Station was 5 ppt* with a range of 3 to 8 ppt as compared to an average of 11 ppt and a range of 7.5 to 13.5 ppt in 1967-68. During 1960-61, the average surface salinity for Lena's Lagoon was 7.5 ppt with a range of 3.5 to 15 ppt as compared to an average of 13 ppt with a range of 8.5 to 19 ppt in 1967-68. During 1962-63, the average salinity at Stump Lagoon was 9 ppt with a range of 3 to 22 ppt as compared to an average of 14 ppt with a range of 10 to 18 ppt in 1967-68. During 1963-65, the average salinity at Brick Lagoon was 4 ppt with a range of 2 to 8 ppt as compared to an average of 10.5 ppt with a range of 7 to 13.5 ppt in 1967-68. Lake Eloi, the most saline station, was affected least of all by the Outlet. The average salinity in 1960-61 was 17 ppt as compared to an average of 15.5 ppt in 1967-68. Salinity averages and ranges for all years recorded are shown in Table 2.

Tide

Tidal variation in the Biloxi Marsh Complex, under normal conditions, varied daily from 6 to 18 inches due to lunar tides. However, greater increases or decreases of water levels occurred during particular periods due to wind tides. East, southeast, and south winds, depending on intensity and duration, caused the water level to rise three to five feet above mean sea level; whereas, a north or northwest wind created the inverse effect. Note that during periods of prevailing high or low wind tides, lunar high and low tides occurred within this system during the twenty-four hour period.

* Denotes parts per thousand throughout this report.

Table 2
Yearly Average Salinities (ppt) and Ranges that Occurred at The Various Sampling Stations for Period July 1960 - July 1968.

Year	*Lake Borgne*		*Lena's Lagoon*		*Stump Lagoon*		*Brick Lagoon*		*Lake Eloi*	
	Avg.	*Range*	*Avg.*	*Range*	*Avg.*	*Range*	*Avg.*	*Range*	*Avg.*	*Range*
1960-61	5	3-8	7.5	3.5-15					18	7-31
1961-62	4	1-9	8	1-17.5	9	3-22			11.5	2-17.5
1962-63	10.5	7-14	16	11-26	20	17-24			24.5	18-31
1963-64	4	1-8.5	12	9-16	15	10.5-18	4	2-8	21.5	15-31
1964-65	7	3-10	12	7-16	13	6-18.5	7	3.5-12	14	8-23
1965-66	10	6-18	14	8-20	16	6.5-20	12	7-19	15	8-21
1966-67	10	5-13	13.5	4.5-19	14.5	11-19.5	9	1-14	16	10-24
1967-68	11	7.5-13.5	14	8.5-19	14	10-18	10.5	7-13.5	16	10-21

SAMPLING PROCEDURE AND METHODS

Fish Population Sampling

Trammel Net: Sport fish and other fin-fishes were sampled with the 200 yard trammel net (5 feet deep, 1¼ inch mesh square, 2½ inch mesh stretched) from five areas in the Biloxi Marsh. The areas included Brick Lagoon (29° 57′ Latitude, 89° 3′ Longitude), Stump Lagoon (29° 53′ Latitude, 89° 31′ Longitude), southwestern pocket of Lake Borgne (30° 00′ Latitude, 89° 40′ Longitude), and Lena's Lagoon (29° 46′ Latitude, 89° 27′ Longitude), (Fig. 1).

Each of these five sampling areas was sampled once every three weeks.* One end of the net was staked at the shoreline and the rest of the net was placed in the form of a semicircle. When the net was completely put out, the loose end was dragged parallel and as near to the shoreline as possible. The net was pulled toward the location of the original stake forming an enclosed circle upon reaching it. The area inside the net was then churned up with the boat and outboard motor causing most of the enclosed fishes to hit the net. The net was picked up by tying one of the ends to the boat and retrieving the other end. This resulted in completely closing the circle capturing fishes that had previously not hit the net.

Each sample consisted of two subsamples taken on the sample day. The subsamples were adjacent to each other in both time and space.

All fishes captured were identified, weighed and measured. The gonadal condition of the spotted seatrout, *Cynoscion nebulosus*, spot, *Leiostomus xanthurus*, atlantic croaker, *Micropogon undulatus*, black drum, *Pogonias cromis*, and red drum, *Sciaenops occellata*, were examined. The gonadal condition was recorded as being either adolescent, immature, maturing, mature, ripe or spent.

During every third three-week sampling sequence, stomachs of the spotted seatrout, spot, atlantic croaker, black drum, and red drum were removed and placed in 10

* Sampling of all stations during the three weeks sampling sequences was not always possible because of inclement weather and equipment breakdowns.

percent formalin solution. Their contents were later analyzed in the New Orleans fisheries laboratory. The stomach organisms were keyed to genus and species whenever possible.

Trawl, Bobbinet and Cast Net: Because of the size selectivity of the trammel net mesh, smaller fishes and crustaceans were collected with an otter trawl, bobbinet and cast net in order to complete as nearly as possible a species list of all fishes which inhabit and compete in the environment of the study area.

The 16 foot otter trawl, ¾ inch mesh, was dragged for five minutes and the 8 foot bobbinet, ¼ inch mesh, was dragged for one minute. These samples were taken during every third three-week sampling sequence of the trammel net and occurred adjacent to the trammel net set in both time and space.

Weekly 6 foot cast net (¼ inch mesh) samples were taken at two weirs located in Bayou Hasouse (29° 55′ Latitude, 89° 34′ Longitude), and Blind Bayou (29° 55′ Latitude, 89° 35′ Longitude.* A sample was a combination of one cast in front of the weir and two casts behind the weir.

All organisms captured in the trawl bobbinet and cast net were recorded, counted and identified to genus and species.

Sporting Tackle and Hook and Line: Sporting tackle and hook and line were used to capture sportfish for tagging purposes. No definite stations occurred for this particular job. Tagging occurred throughout the Biloxi Marsh Complex.

The sport fish were tagged with a yellow "spaghetti" floy tag lodged just above the vertebrae near the posterior end of the dorsal fin. The date and location in which the fish was captured, released, and recaptured was measured whenever possible. The distance traveled by a recaptured fish was recorded.

Hydrological Data

Chemical and Physical Data: During fish population sampling with the trammel net, three-one liter jars of water were collected at the sampling station. From these water

* The weekly sampling schedule could not always be followed because of inclement weather and extremely low tides.

samples the following hydrological data was determined using the standard methods procedure: salinity (ppt), turbidity, chloride (ppm), CO_2 (ppm), pH, carbonate, bicarbonate and total alkalinity. All were calculated in the field using a Hach kit, except for chloride and turbidity which were determined in the New Orleans fisheries laboratory.

During each sampling period, tidal condition and water temperature in degrees centigrade were recorded.

RESULTS AND DISCUSSION

Sixty-eight species of fin-fishes with representatives in 37 families and 14 orders of class osteichthyes were captured during this investigation (Table 3).

The family Scaienidae was the dominant family in the study area, and contained the most sought-after species by sport fishermen. The more important and numerous Sciaenids included the spotted seatrout, *Cynoscion nebulosus*, spot, *Leiostomus xanthurus*, atlantic croaker, *Micropogon undulatus*, black drum, *Pogonias cromis*, and red drum, *Sciaenops occellata.*

Spotted seatrout, *Cynoscion nebulosus*

Seasonal relative abundance and size distribution: The spotted seatrout was found in the lagoon and lake areas throughout the year. However, a peak in numbers occurred in the fall period and another smaller peak appeared in the spring (Fig. 2). During the fall peak, October was generally the greatest month, while during the spring peak April was more significant.

Spotted seatrout weighing from 0.5 pounds to 1.5 pounds composed approximately 65 percent of the population sampled (Fig. 3) and were in the 11 to 16 inch class category (Fig. 4). The largest spotted seatrout collected weighed approximately 6 pounds. Chances of catching larger spotted seatrout were increased during April and May and again in November (Fig. 5).

Table 3

Species list of fishes captured with the 200 yard trammel net, 16 foot otter trawl, 8 foot bobbinet and 6 foot cast net in the Biloxi Marsh during the period 1960-68, all stations combined

Cephalopoda	
Diabranchia	
Loliginidae	
Loliginidae brevis	squid
Crustacea	
Isopoda	
Cymothoidae	
Livoneca ovalis	Isopod
Amphipoda	
Gammaridae	
Gammarus sp.	amphipod
Decapoda	
Penaeidae	
Penaeus aztecus	Brown shrimp
Penaeus setiferus	white shrimp
Palaemonidae	
Palaemonidae vulgaris	Grass shrimp
Squillidae	
Squillia empura	King shrimp
Paguridae	
Pagurses longicarpus	Hermit crab
Portunidae	
Callinectes sapidus	Blue crab
Xanthidae	
Menippe mercenaria	Stone crab
Panopeus herbstii	Mud crab
Chondrichtayes	
Squaliformes	
Carcharinidae—requiem sharks	
Carcharhinus leucas	Bull shark

Table 3 (cont)

Rajiformes	
Dasyatidae—stingrays	
Dasyatis americana	southern stingray
Dasyatis sabina	Atlantic stingray
Dasyatis sayi	Bluntnose stingray
Osteichthyes	
Acipenseriformes	
Acipenseridae—sturgeons	
Scaphirhynchus platorynchus	Shovelnose sturgeon*
Semionotiformes	
Lepososteidae—gars	
Lepisosteus oculatus	Spotted gar
Lepisosteus osseus	Longnose gar
Lepisosteus spatula	Alligator gar
Clupeiformes	
Elopeidae—tarpons	
Elops saurus	Ladyfish
Clupeidae—herrings	
Alosa chrysochloris	Skipjack herring
Brevoortia patronus	Largescale menhaden
Dorosoma cepedianum	Gizzard shad

* These species disappeared and were no longer found in the Study Area during the latter half of the project due to an increase in salinity as a result of salt water intrusion from the newly constructed Mississippi River Gulf Outlet.

Table 3 (cont)

Dorosoma petenanse	Threadfin shad
Engraulidae—anchovies	Bay anchovy
Anchoa mitchilli	
Esocidae—pikes	Chain pickerel*
Esox niger	
Myctophiformes	
Synodontidae—lizardfishes	
Synodus foetens	Inshore lizardfish
Cypriniformes	
Ariidae—sea catfishes	
Bagre marinus	Gafftopsail catfish
Galeichthyes felis	Sea catfish
Ictaluridae—freshwater catfishes	
Ictalurus furcatus	Blue catfish
Ictalurus punctatus	Channel catfish
Pylodictis olivaris	Flathead catfish
Anguilliformes	
Ophichthidae—snake eels	
	Snake eel sp.
Beloniformes	
Belonidae	
Strongylura marina	Atlantic needlefish
Cyprinodontiformes	
Cyprinodontidae—killifishes	
Cyprinodon variegatus	Sheepshead minnow

* These species disappeared and were no longer found in the Study Area during the latter half of the project due to an increas in salinity as a result of salt water intrusion from the newly constructed Mississippi River Gulf Outlet.

Table 3 (cont)

Fundulus grandis	Gulf killifish
Poeciliidae—livebearers	
Gambusia affinis	Mosquitofish
Mollienesia latipinna	Sailfin molly
Gadiformes	
Syngnothidae—pipefishes	
	Pipefish sp.
Perciformes	
Serranidae—sea basses	
Roccus mississippiensis	Yellow bass*
Centrarchidae—sunfishes	
Chaenobryttus gulosus	Warmouth*
Lepomis humilis	Orange-spotted sunfish*
Lepomis macrochirus	Bluegill*
Lepomis microlophus	Redear sunfish*
Lepomis punctatus	Spotted sunfish*
Micropterus salmoides	Largemouth bass*
Percidae—perches	
Stizostedion canadense	Sauger*
Carangidae—jacks, scads and pompanos	
Caranx hippos	Crevalle jack
Oligoplites saurus	Leather-jacket
Trachinotus carolinus	Pompano
Sciaenidae—drums	
Aplodinotus grunniens	Freshwater drum

* These species disappeared and were no longer found in the Study Area during the latter half of the project due to an increas in salinity as a result of salt water intrusion from the newly constructed Mississippi River Gulf Outlet.

Table 3 (cont)

Bairdiella chrysura	Silver perch
Cynoscion arenarius	Sand sea-trout
Cynoscion nebulosus	Spotted sea-trout
Leiostomus xanthurus	Spot
Menticirrhus americanus	Southern kingfish
Menticirrhus littorahs	Gulf king-fish
Micropogon undulatus	Atlantic croaker
Pogonias cromis	Black drum
Sciaenops occellata	Red drum
Sparidae—porgies	
Archosargus probatochephalus	Sheepshead
Lagodon rhomboides	Pinfish
Ephippidae—spadefishes	
Chaetodipterus faber	Atlantic spadefish
Labridae—wrasses	
Lachnolaimus maximus	Hogfish
Trichiuridae—cutlassfishes	
Trichiurus lepturus	Atlantic cutlassfish
Scombridae—mackerels and tunas	Spanish mackerel
Scomberomorus maculatus	
Gobiidae—gobies	Goby sp.
Triglidae—searobins	
Prionotus tribulus	Bighead searobin
Blenniidae—combtooth blennies	
	Blenny sp.

Table 3 (cont)

Stromateidae—butterfishes	
Peprilus alepidotus	Southern harvestfish
Mugilidae—mullets	
Mugil cephalus	Striped mullet
Atherinidae—silversides	
Menidia beryllina	Tidewater silverside
Pleuronectiformes	
Bothidae—lefteye flounders	
Paralichthys lethostigma	Southern flounder
Soleidae—soles	
Achirus lineatus	Lined sole
Trinectes maculatus	Hogchoker
Cynoglossidae—tonguefishes	
Symphurus plagiusa	Blackcheek tonguefish
Tetraodontiformes	
Tetraodontidae—puffers	
Sphaeroides nephelus	Southern puffer
Diodontidae—porcupinefishes	
Chilomycterus schoepfi	Striped burrfish
Batrachoidiformes	
Batrachoididae	
Opsanus beta	Gulf toadfish

Figure 2. Trammel net catch showing relative monthly abundance of the Spotted Seatrout combining catch from all stations for the period 1960-68.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Spotted Seatrout captured}}{\text{Total number of sets}}$$

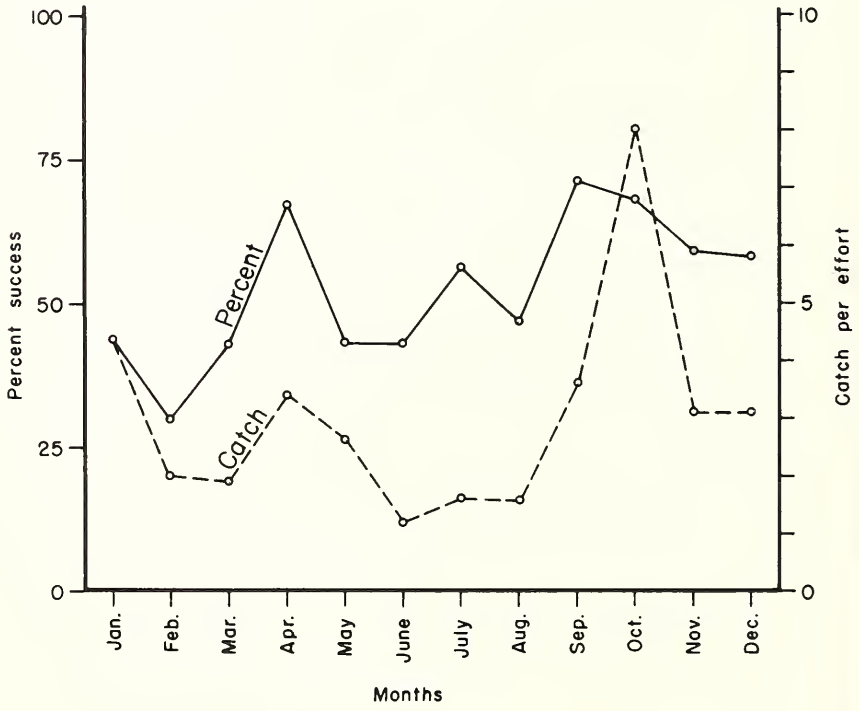


Figure 3. Percent occurrence of various weights of the Spotted Seatrout captured during the period 1960 - 1968, combining all stations.

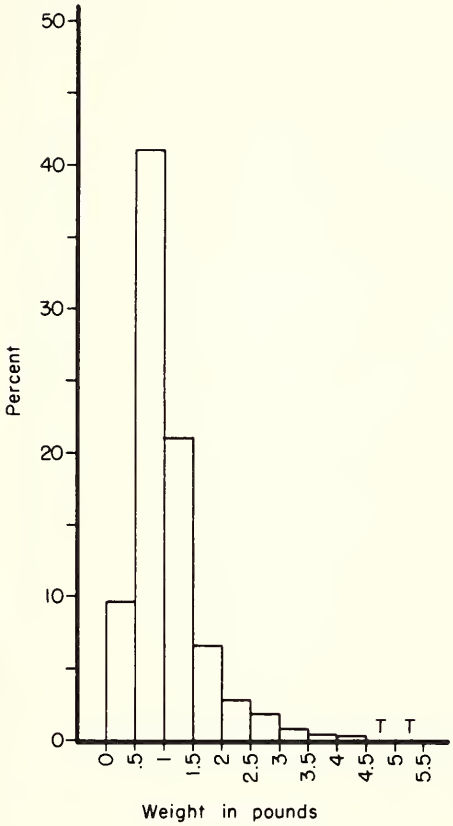


Figure 4. Percent occurrence of various lengths of the Spotted Seatrout captured during the period 1960-1968, combining all stations.

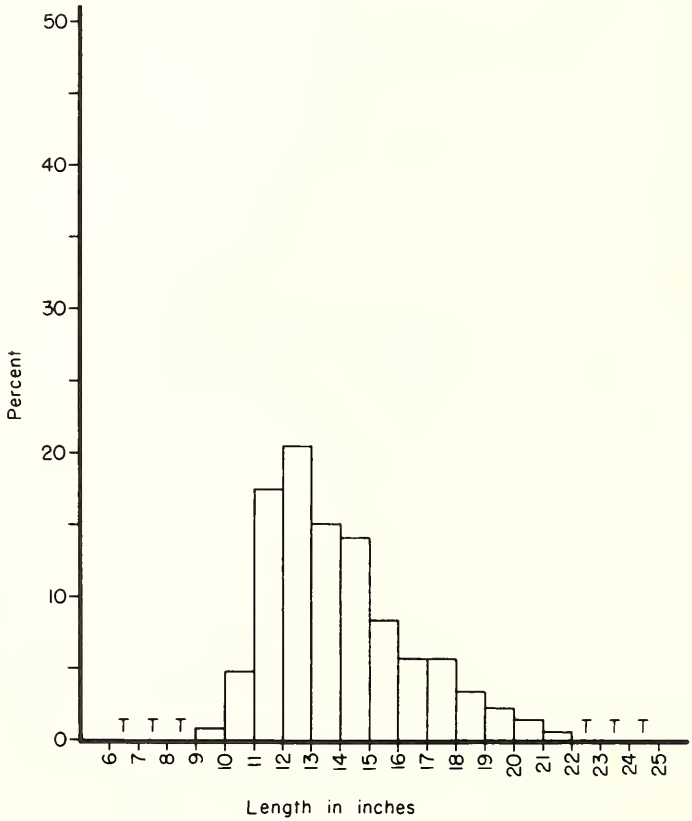
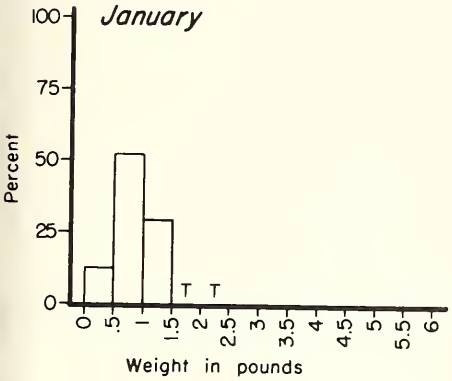
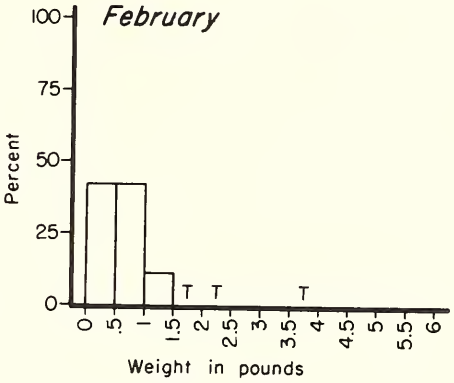
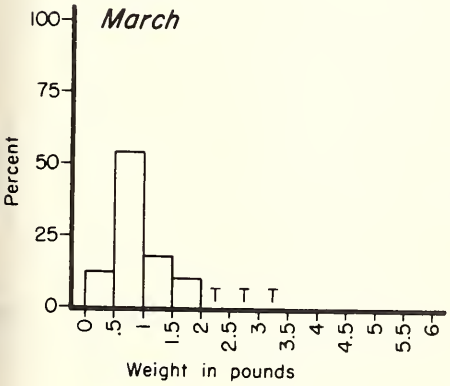


Figure 5. Percent occurrence of various weights by months of the Spotted Seatrout captured during the period 1960-1968, combining all stations.







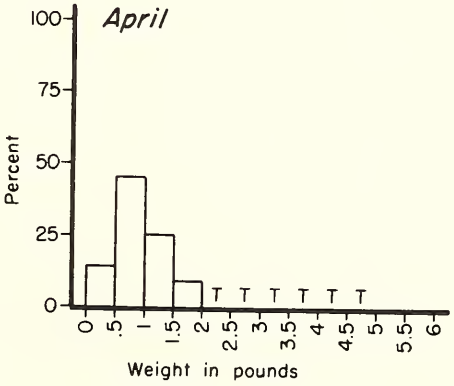
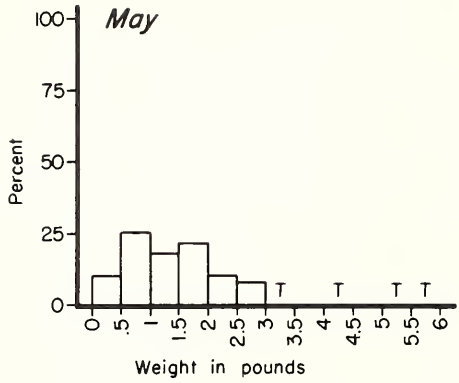
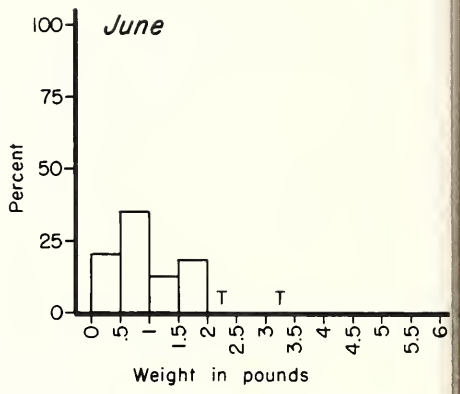
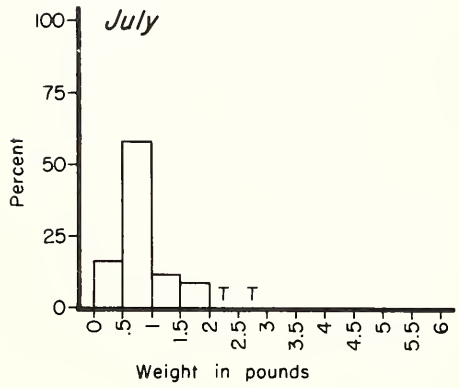


Figure 5. Spotted Seatrout, continued.







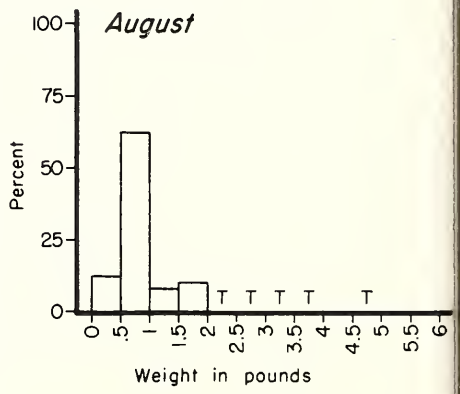
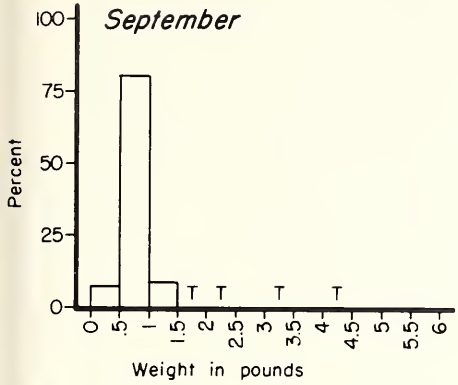
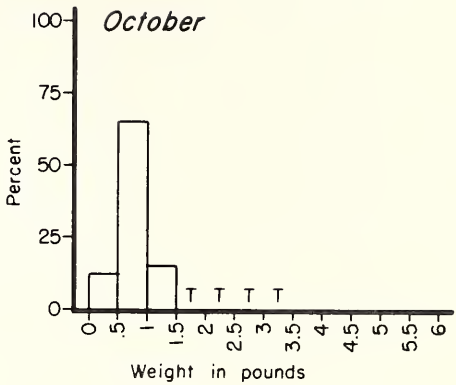
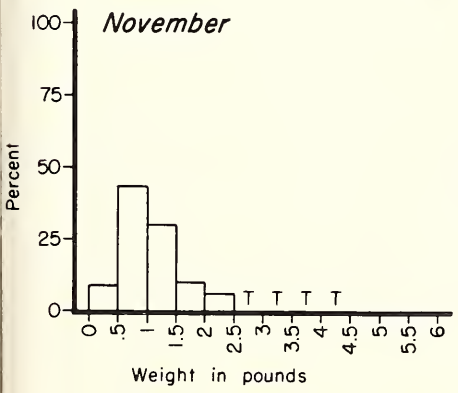
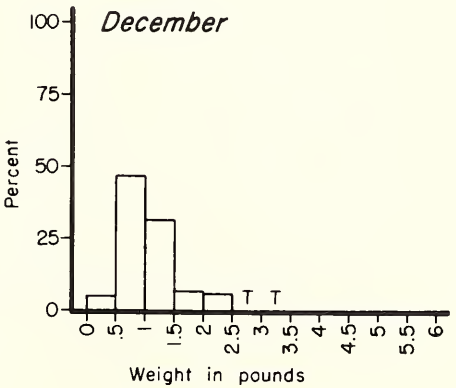


Figure 5. Spotted Seatrout, continued.









Movement data is shown in Table 4.

Temperature and catch: Catch was generally higher during temperature range 26°C to 30°C as compared to other ranges (Fig. 6). This held true during the months of March, April, May and September (Fig. 7). However, during the fall peak catch of October and November, temperature range 21°C to 25°C was as productive or more productive than range 26°C to 30°C. During June through August, catches decreased when the spotted seatrout remained in the cooler and deeper bayou waters and ventured into the lagoon and lake areas mostly during night periods or during cloudy and/or rainy days when the water temperature was lowered. It was noted that successful catches did occur during winter periods when temperatures were relatively low. However, these successful catches were made primarily during sunny days that were preceded by cold and cloudy weather, after which, the shallow lagoon waters containing a larger surface area absorbed more sunlight and began to warm at a more rapid rate attracting the spotted seatrout. Otherwise fishing for the spotted seatrout was more successful in bayous and deep holes during cold water temperature periods.

Salinity and catch: The normal increases or decreases of salinities that occurred periodically within the Biloxi Marsh Complex appeared not to affect the catch of spotted seatrout near as significantly as did the changes in water temperatures and tidal conditions. During many of the individual months, peak catches appeared during both the high and low extremes of salinities sampled (Fig. 8). During other months, little variation was apparent in catch when comparing one salinity range to another.

Movement Data of Tagged Sportfishes Recaptured During the Period 1960-68 in the Biloxi Marsh Complex

Species	*Date Released*	*Area Released*	*Date Recaptured*	*Area Recaptured*	*Distance Traveled*
Spotted seatrout	9/26/61	SW Section of Lake Borgne	10/25/61	Mouth of Bayou Padre at Lake Borgne	5 miles
Spotted seatrout	11/16/61	Weir-Bayou Hasouse	12/5/61	Mouth of Bayou Hasouse at Lake Borgne	2 miles
Spotted seatrout	11/9/62	Bayou Alphonso	11/11/62	Lena's Lagoon at Miss. River Ship Channel	2-3 miles
Spotted seatrout	8/31/66	Dead Man Island	Latter days 9/66	Miss. River at Shell Beach	20 miles
Spotted seatrout	9/22/66	Dead Man Island	Latter days 9/66	Miss. River Gulf Outlet at Shell Beach	20 miles
Spotted seatrout	10/9/67	Hopedale in Oil Co. Canal	1/24/68	Lake Coquille	10 miles
Black drum	9/22/66	Lake Borgne at Shell Beach	10/29/66	Lena's Lagoon	5 miles
Black drum	10/8/67	Hopedale-Oil Co. Canal	12/15/67	Delacroix Island	10 miles
Black drum	6/6/68	Nick's Lagoon	6/15/68	Bayou Guayago	1 mile
Black drum	6/14/68	Weir-Bayou Hasouse	6/68	Magnolia Mound	3 miles
Red drum	6/12/67	Janckhe Ditch at Lake Borgne	11/5/67	Chef Pass 2	20 miles
Red drum	8/22/67	Long Bay	8/67	Long Bay	.....

Figure 6. Trammel net catch showing the relative abundance of the Spotted Seatrout at various temperature ranges which occured during the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Spotted Seatrout captured}}{\text{Total number of sets}}$$

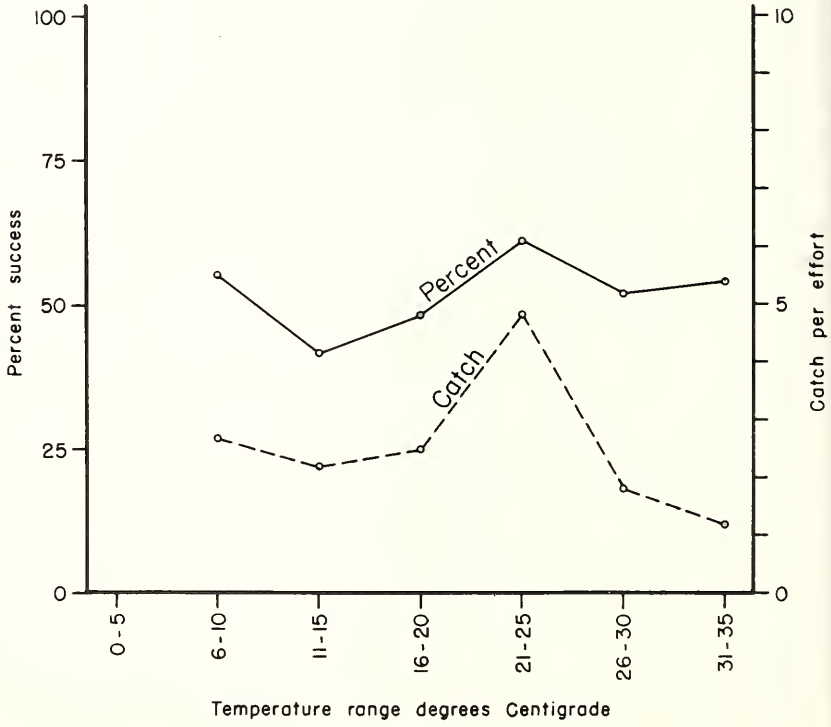


Figure 7. Trammel net catch showing the relative abundance of the Spotted Seatrout at various temperature ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Spotted Seatrout captured}}{\text{Total number of sets}}$$

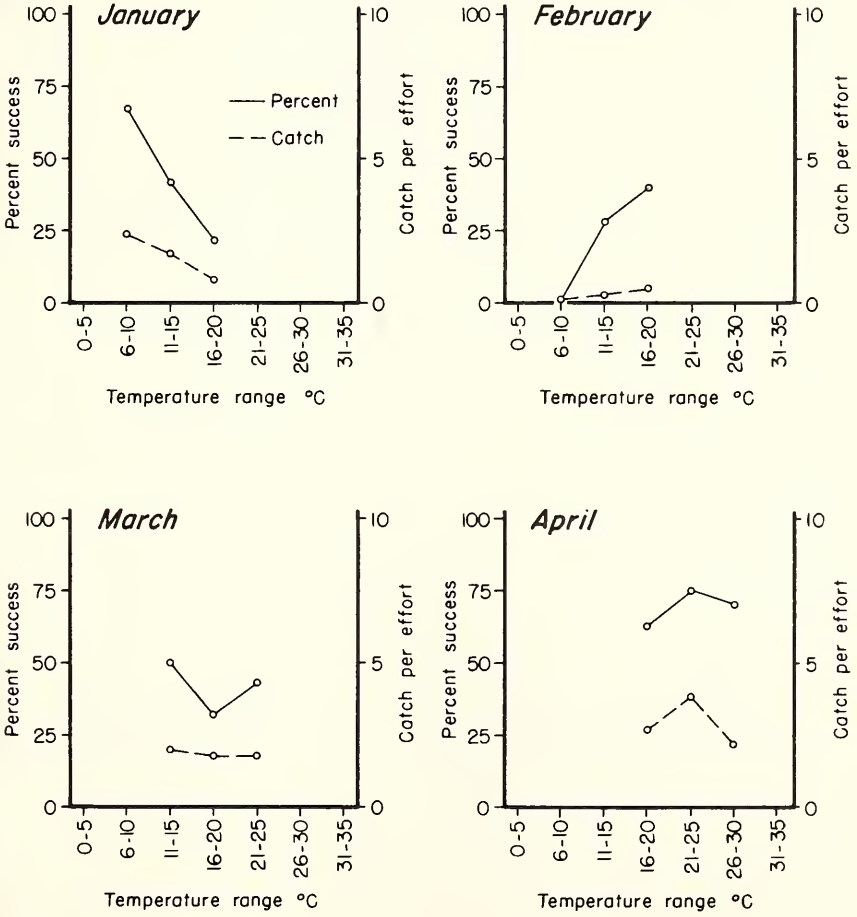


Figure 7. Spotted Seatrout, continued.

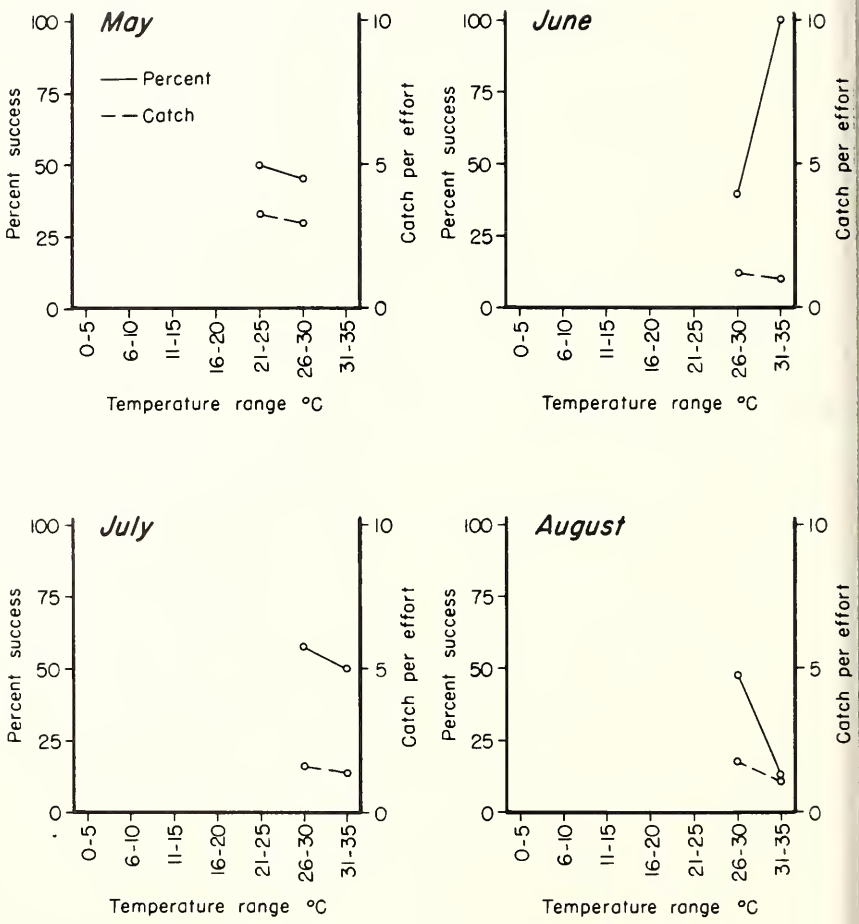


Figure 7. Spotted Seatrout, continued.

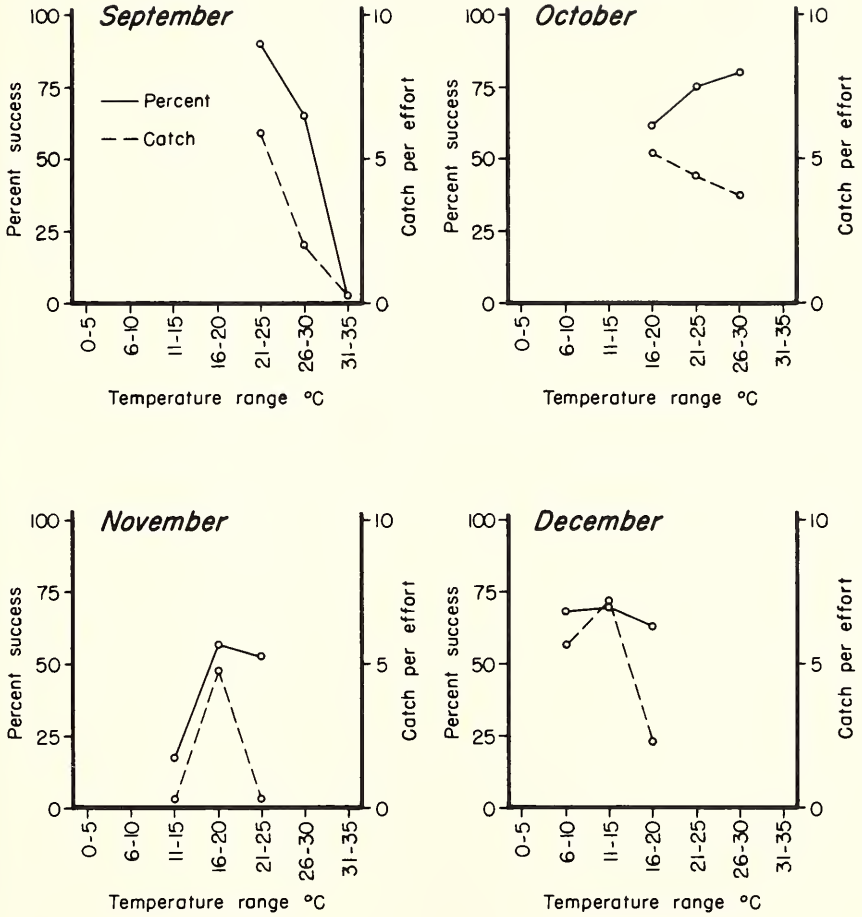


Figure 8. Trammel net catch showing the relative abundance of the Spotted Seatrout at various salinity ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Spotted Seatrout captured}}{\text{Total number of sets}}$$

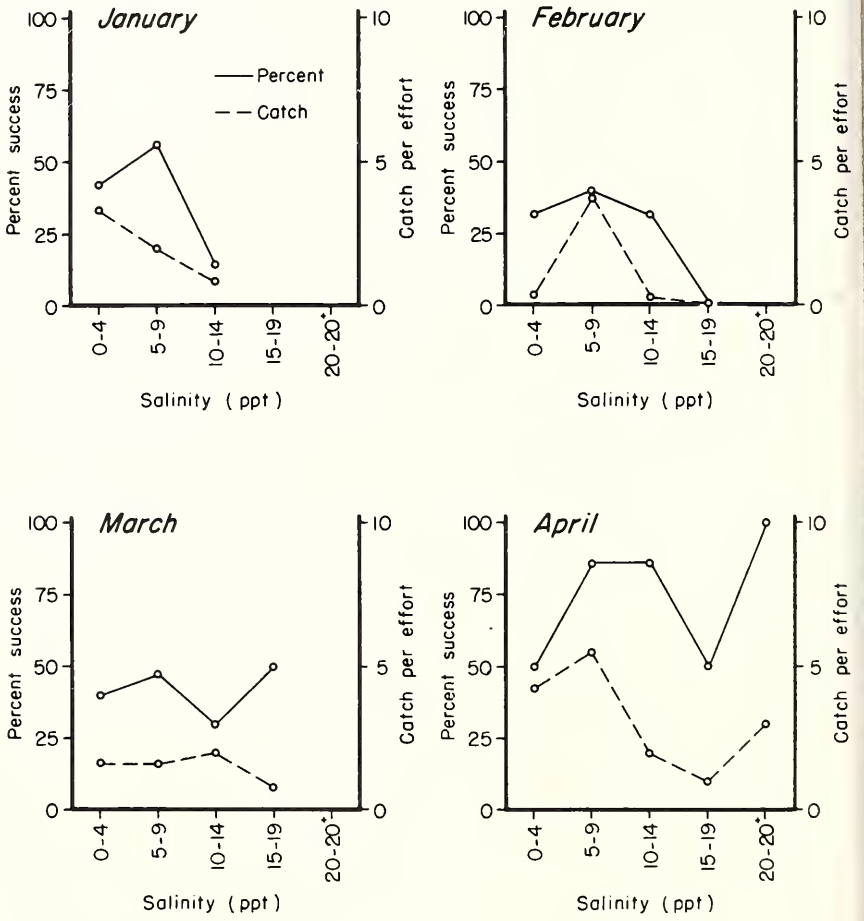


Figure 8. Spotted Seatrout, continued.

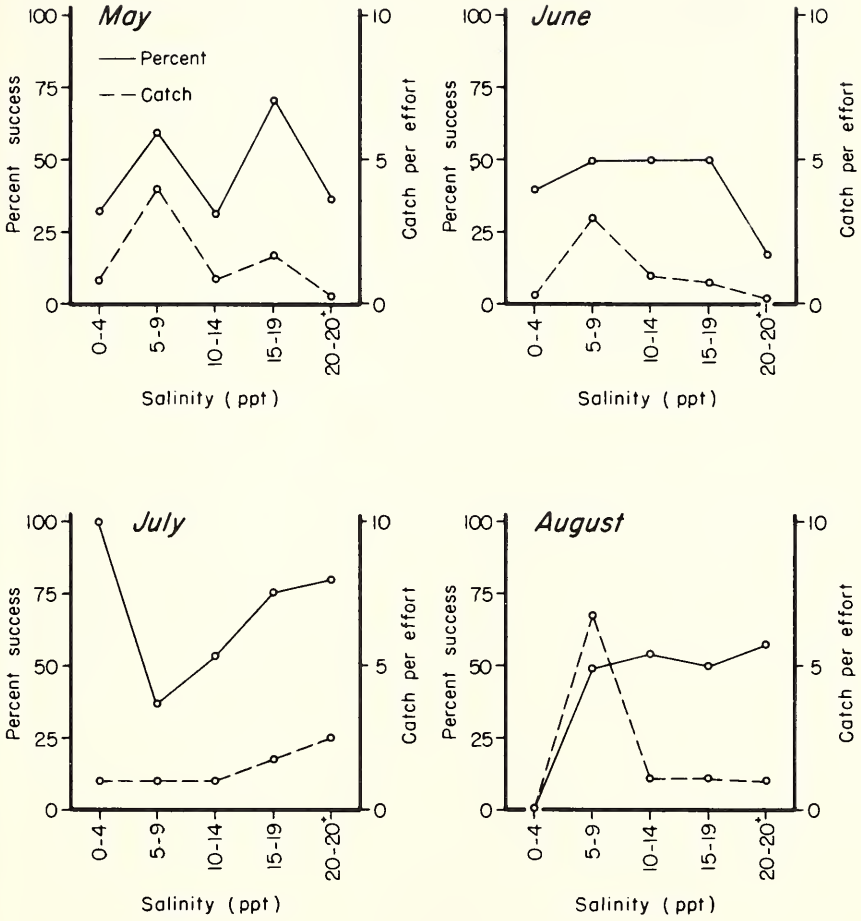
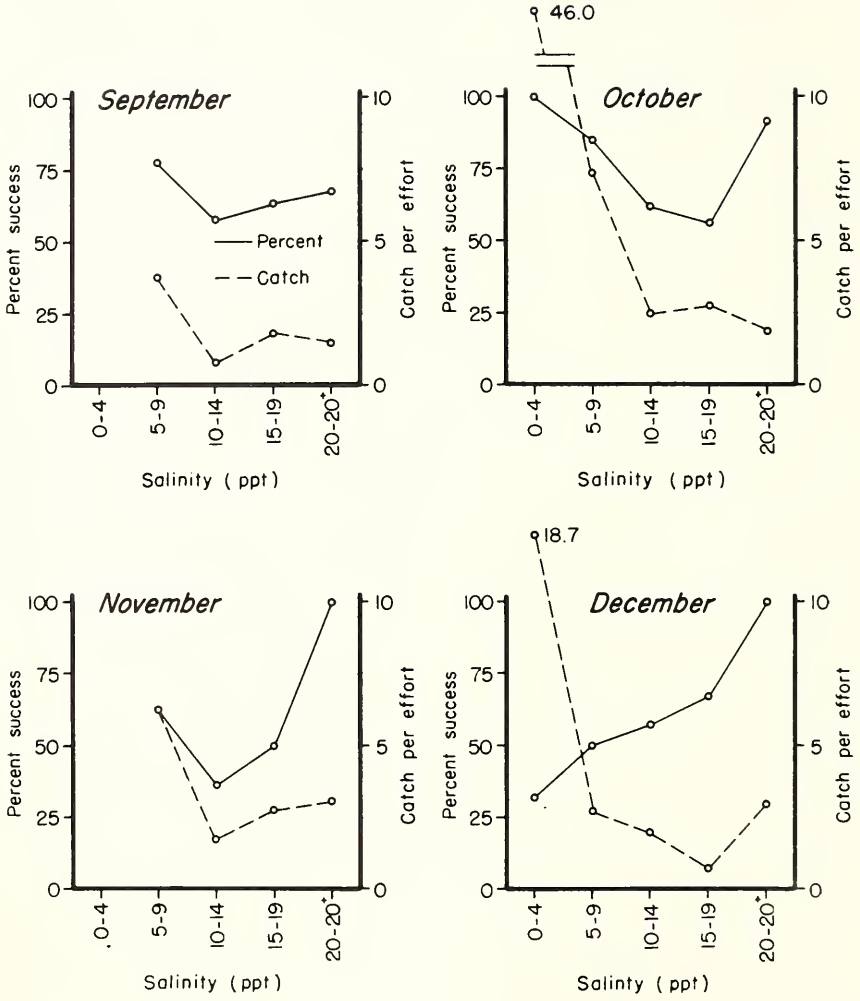


Figure 8. Spotted Seatrout, continued.



Tide and catch: Samples were generally more successful in the fall and winter when sampling occurred during prevailing high and normal tidal conditions (Fig. 9). Definite peaks in catches occurred in October and in November during prevailing high-falling tidal conditions, in December during prevailing high-high ebb, and in January and February during normal-rising and falling, and normal-high ebb respectively. In contrast, successful catches under low tidal conditions occurred during April, July and September. Peak catches occurred in May during normal-falling conditions and prevailing high-rising conditions; and, in June during a normal-low ebb. Catch under the various tidal categories showed little differentiation during March and August.

Stomach analyses: Four-hundred six stomachs were examined. 225 contained food organisms. Crustaceans occurred in 25 percent; bony fin-fishes occurred in 71 percent; and unidentifiable digested animal matter in 12.5 percent (Table 5).

Since many of the fin-fishes were partially digested, positive identification was not always possible. The more important fishes identified were the striped mullet, *Mugil cephalus*; largescale menhaden, *Brevoortia patronus*; bay anchovy, *Anchoa mitchelli*; gulf killifish, *Fundulus grandis*; and the atlantic croaker *Micropogon undulatus*. The skeletal structures of the partially digested fin-fishes strongly suggested that most belonged to the species just mentioned.

The favorite crustacean of the spotted seatrout was the *Penaeus* shrimp, and secondly, juvenile blue crabs.

Figure 9. Trammel net catch showing the relative abundance of the Spotted Seatrout at various tidal conditions by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Spotted Seatrout captured}}{\text{Total number of sets}}$$

LEGEND-

NR = Normal, rising	HR = Prevailing high, rising	LR = Prevailing low, rising
NF = " , falling	HF = " " , falling	LF = " " , falling
NH = " , high ebb	HH = " " , high ebb	LH = " " , high ebb
NL = " , low ebb	HL = " " , low ebb	LL = " " , low ebb

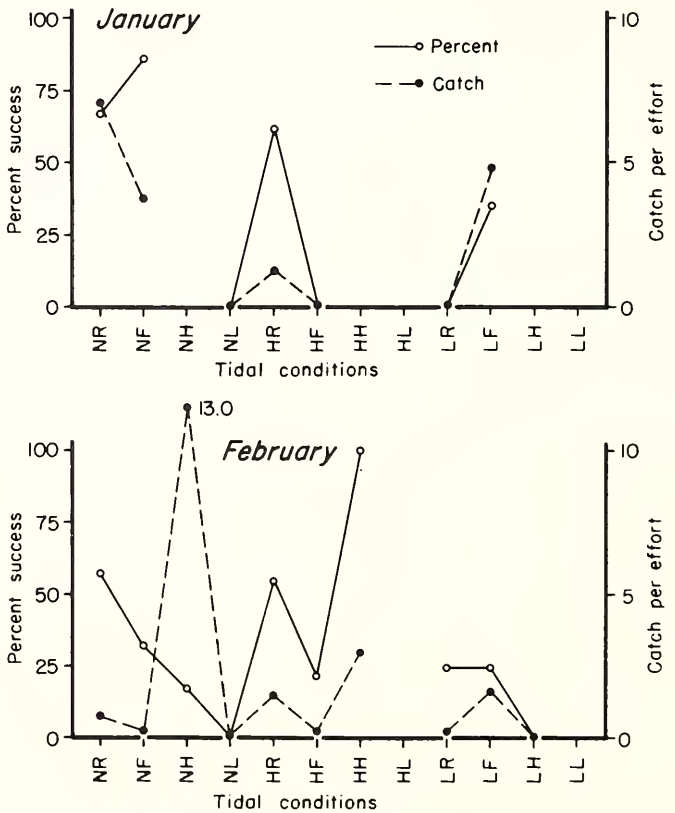


Figure 9. Spotted Seatrout, continued.

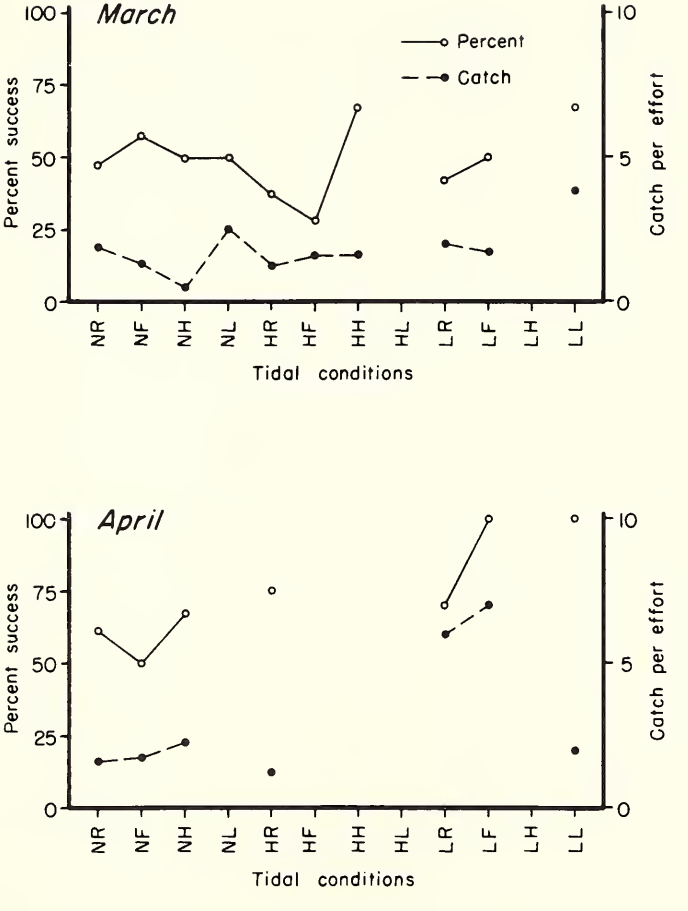


Figure 9. Spotted Seatrout, continued.

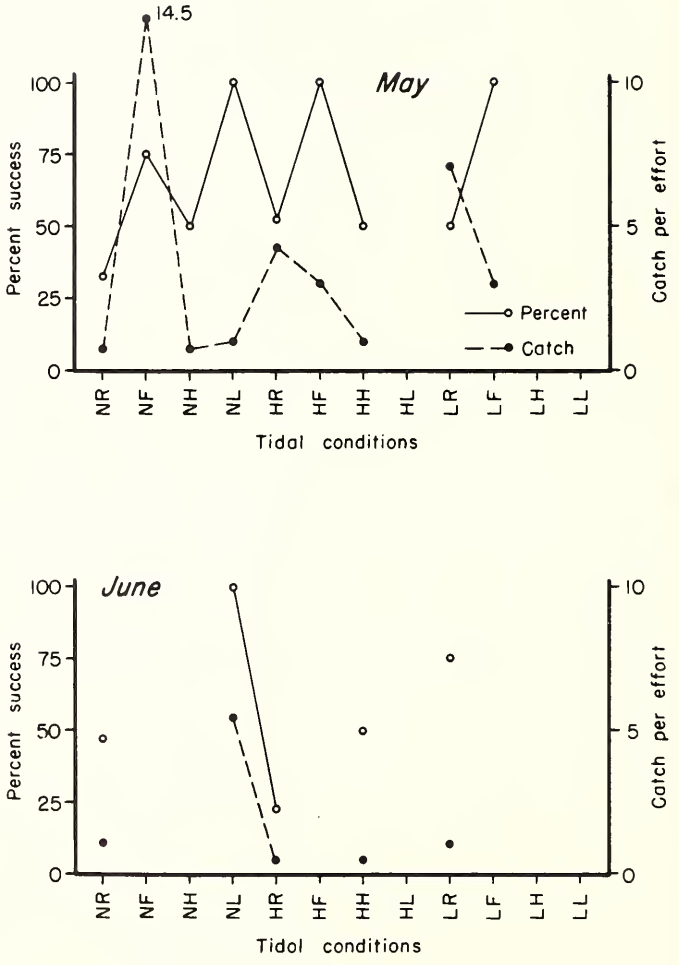


Figure 9. Spotted Seatrout, continued.

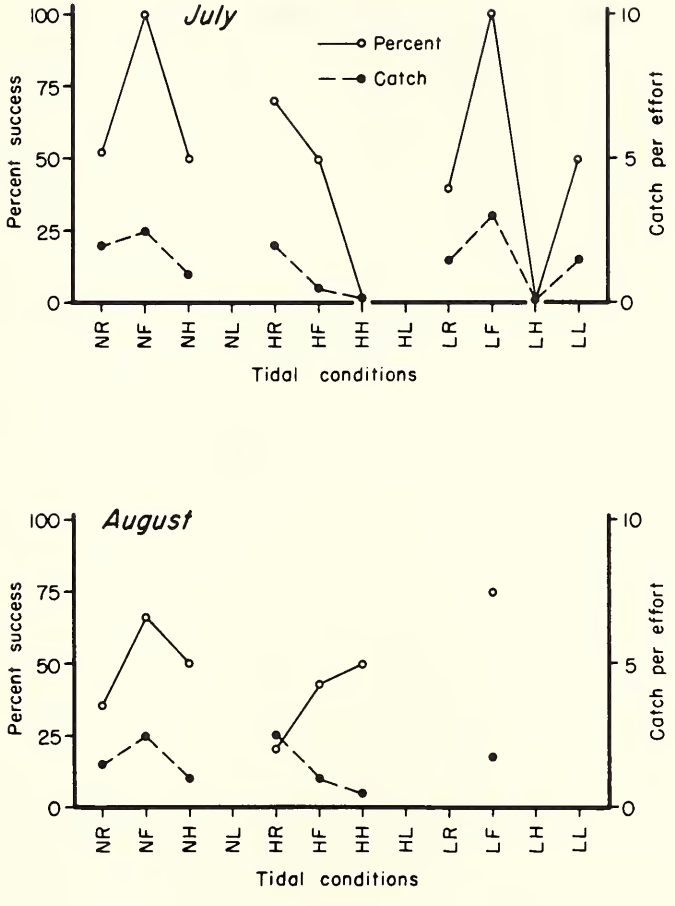


Figure 9. Spotted Seatrout, continued.

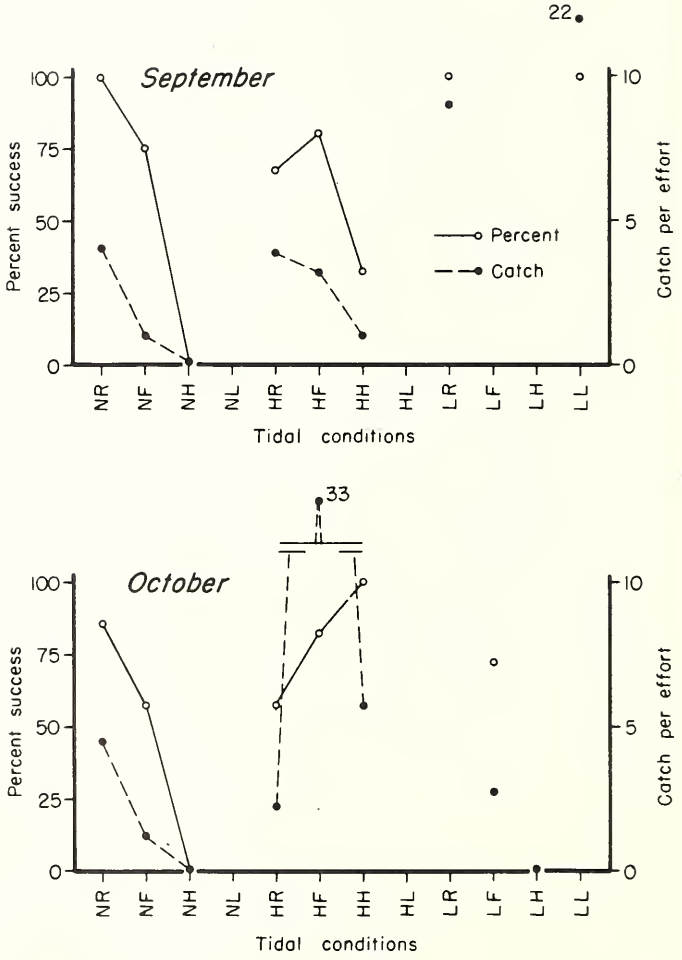


Figure 9. Spotted Seatrout, continued.

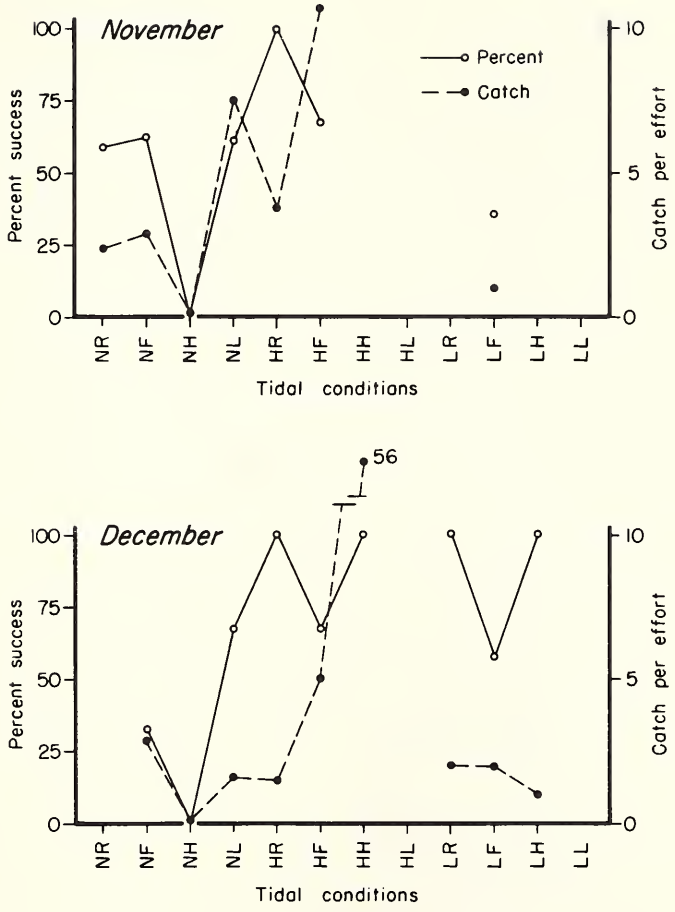


Table 5

Spotted seatrout stomach contents with number and percent occurrence of stomachs containing them 406 stomachs examined; 225 contained food; 181 empty

Stomach contents	*No. Stomachs*	*% Occurrence*
Crustacea	*57*	*25.0*
Isopoda		
Cymothaidae		
Isopod	2	0.9
Amphipoda		
Gammaridae		
Amphipod	3	1.3
Decapoda		
Penaeidae		
Penaeid shrimp	32	14.0
Palaemonidae		
Grass shrimp	7	3.0
Portunidae		
Blue crab	13	6.0
Osteichthyes	*159*	*71.0*
Clupeiformes		
Clupeidae		
Skipjack herring	1	0.4
Largescale menhaden	3	1.3
Engraulidae		
Bay anchovy	3	1.3
Cyprinodontiformes		
Cyprinodontidae		
Gulf killifish	2	0.9
Perciformes		
Scraemidae		
Atlantic croaker	2	0.9
Eleotridae		
Sleeper species (unidentifiable)	1	0.4
Mugilidae		
Striped mullet	4	1.8
Pleuronectiformes		
Bothidae		

Table 5 (cont)

Stomach contents	*No. Stomachs*	*% Occurrence*
Southern flounder	2	0.9
Tetraodontiformes		
Tetraodontidae		
Southern puffer	2	0.9
Unidentifiable		
(partially digested)	139	62.0
Animal Matter (partially digested)	*28.0*	*12.5*

The preferred and most utilized bait organisms, excluding artificial lures, used to sport fish the spotted seatrout in the Biloxi Marsh Complex are the *Penaeus* shrimp and the gulf killifish.

Gonadal Analyses: The spotted seatrout appeared to commence spawning in April and continued into October (Fig. 10). Spawning, however, was heavier during May through August.

The temperature range, 26°C to 35°C, appeared to be optimum for spawning conditions (Fig. 11).

Atlantic croaker, *Micropogon undulatus*

Seasonal relative abundance and size distribution: The adult atlantic croaker was most abundant in the lagoon and lake areas during April through September becoming scarcer as cooler fall and winter temperatures approached (Fig. 12).

Atlantic croakers weighing from 0.2 to 0.5 pounds composed approximately 90 percent of the population sampled (Fig. 13) and were in the 7.5 to 10.5 inch class category (Fig. 14). The largest Atlantic croaker collected weighed approximately 2.3 pounds.

Temperature and catch: An increase in catch of the Atlantic croaker was directly proportional to an increase in temperature (Fig. 15). This was generally true on a monthly analysis (Fig. 16). Exceptions occurred only during four months—May, August, October and December.

Salinity and catch: No set pattern of success was observed when sampling atlantic croakers during the various salinity ranges (Fig. 17). It appeared that the Atlantic croaker was quite comfortable in waters ranging from a very low salinity to a high salinity, except in the fall and winter when catch was 0 in waters sampled that were below 5 ppt.

Figure 10. Percent occurrence of Spotted Seatrout's gonadal condition by month for period 1960-68, combining all stations.

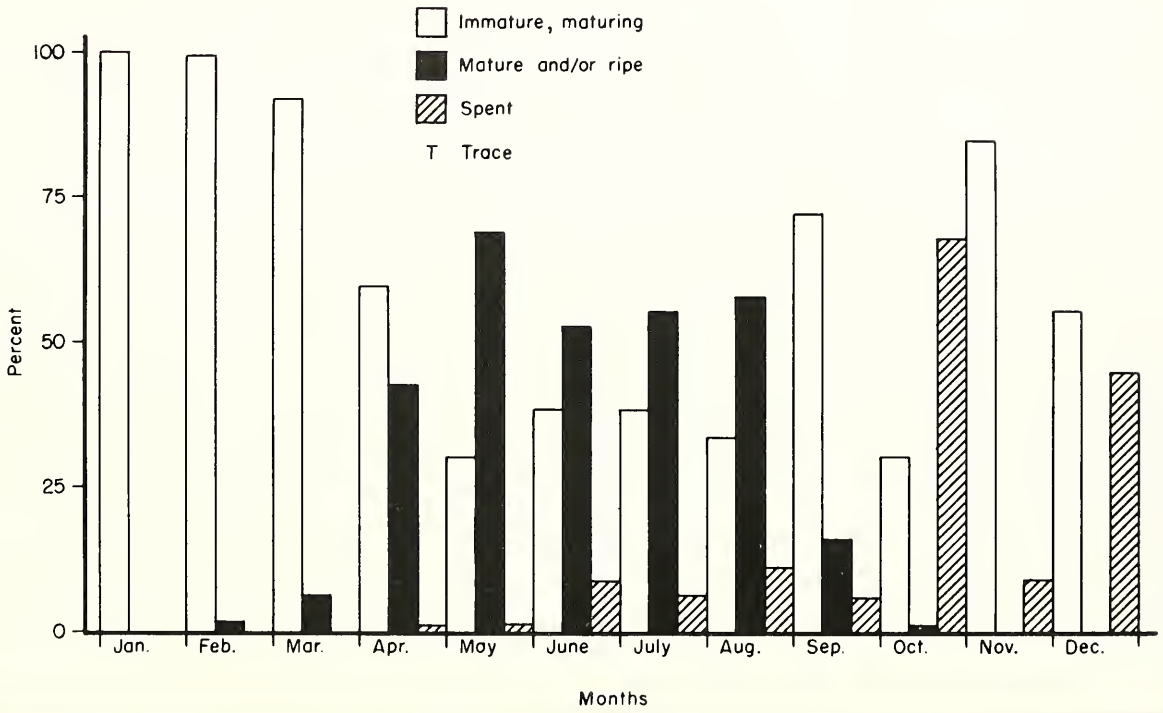


Figure 11. Percent occurrence of Spotted Seatrout's gonadal condition at various temperature ranges for period 1960-68, combining all stations.

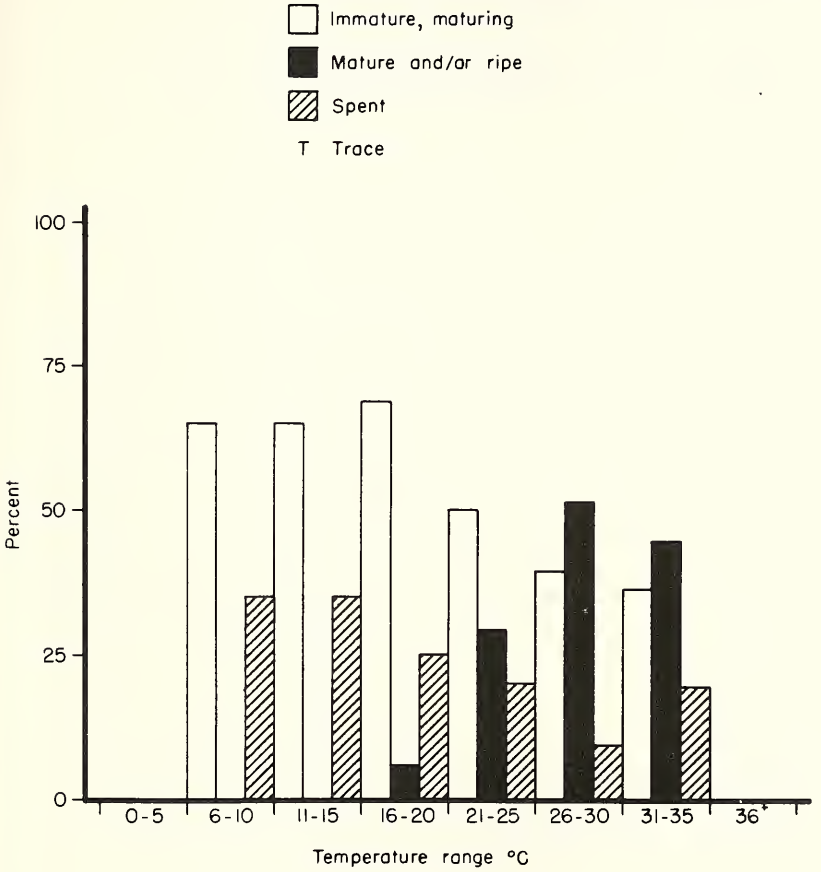


Figure 12. Trammel net catch showing relative monthly abundance of the Atlantic Croaker combining catch from all stations for the period 1960-68.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Atlantic Croakers captured}}{\text{Total number of sets}}$$

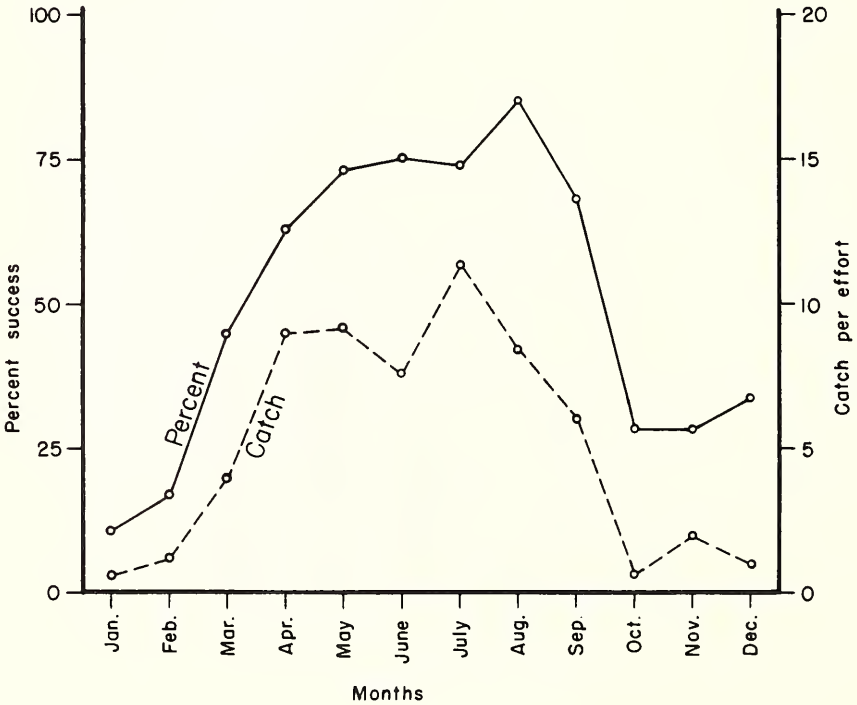


Figure 13. Percent occurrence of various weights of the Atlantic Croaker captured during the period 1960 - 1968, combining all stations.

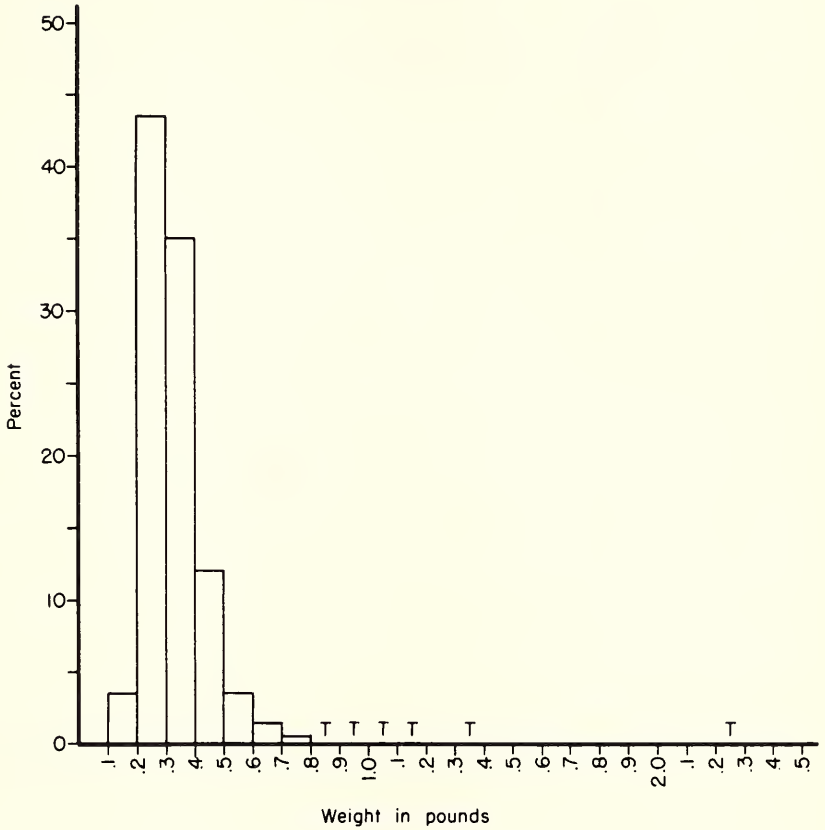


Figure 14. Percent occurrence of various lengths of the Atlantic Croaker captured during the period 1960 - 1968, combining all stations.

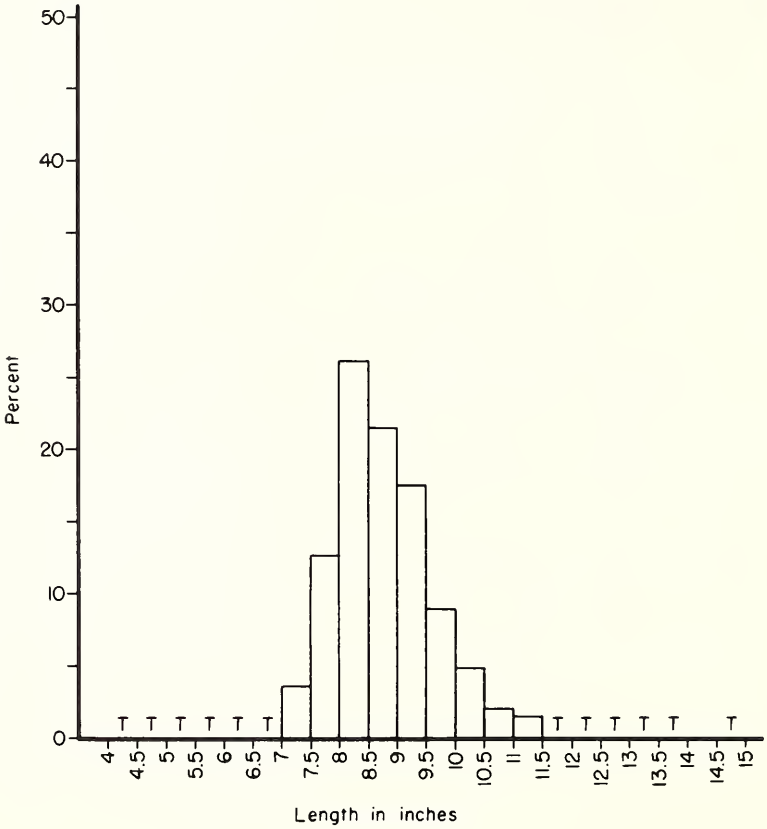


Figure 15. Trammel net catch showing the relative abundance of the Atlantic Croaker at various temperature ranges which occured during the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Atlantic Croaker captured}}{\text{Total number of sets}}$$

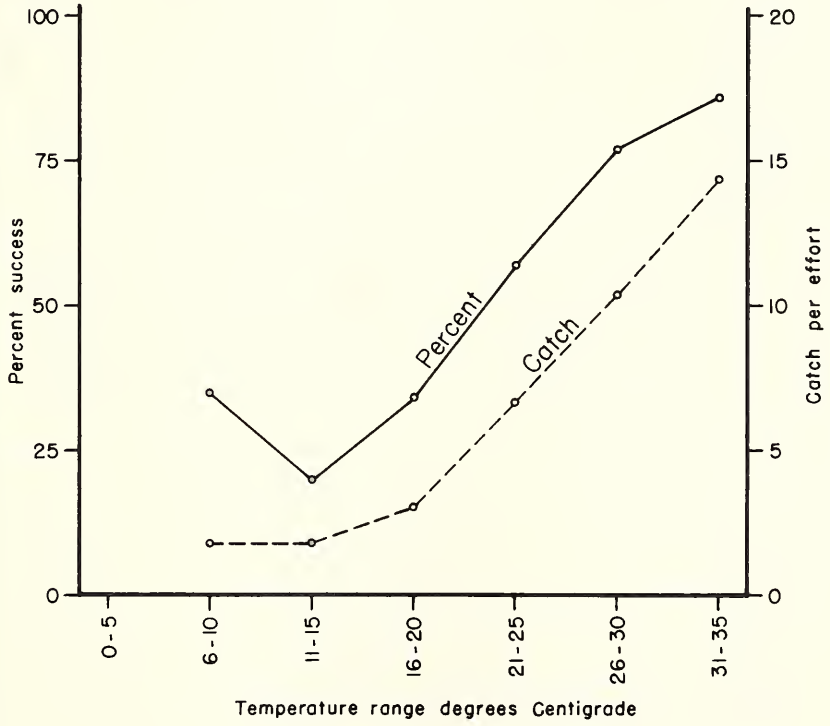


Figure 16. Trammel net catch showing the relative abundance of the Atlantic Croaker at various temperature ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Atlantic Croakers captured}}{\text{Total number of sets}}$$

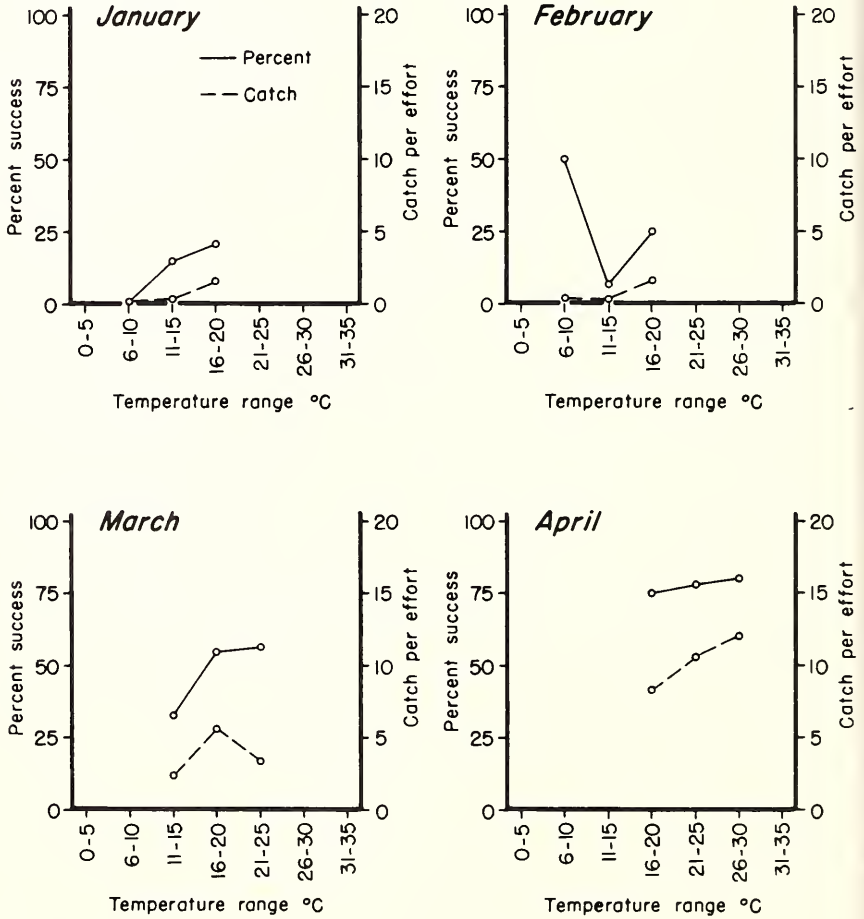


Figure 16. Atlantic Croaker, continued.

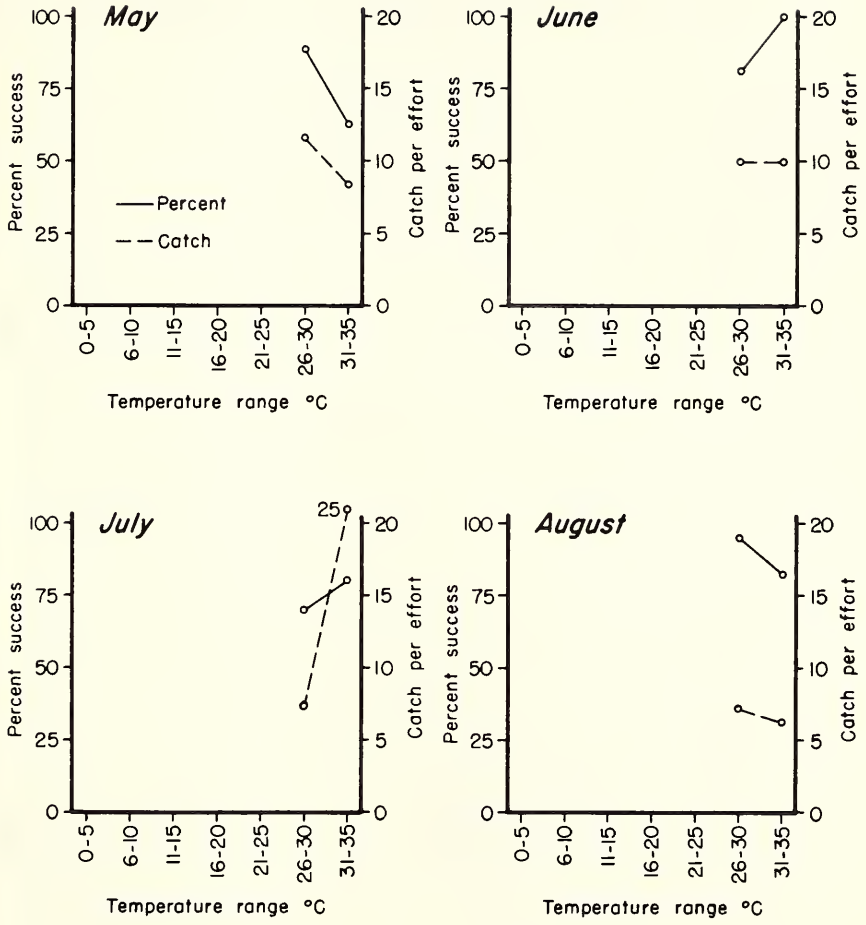


Figure 16. Atlantic Croaker, continued.

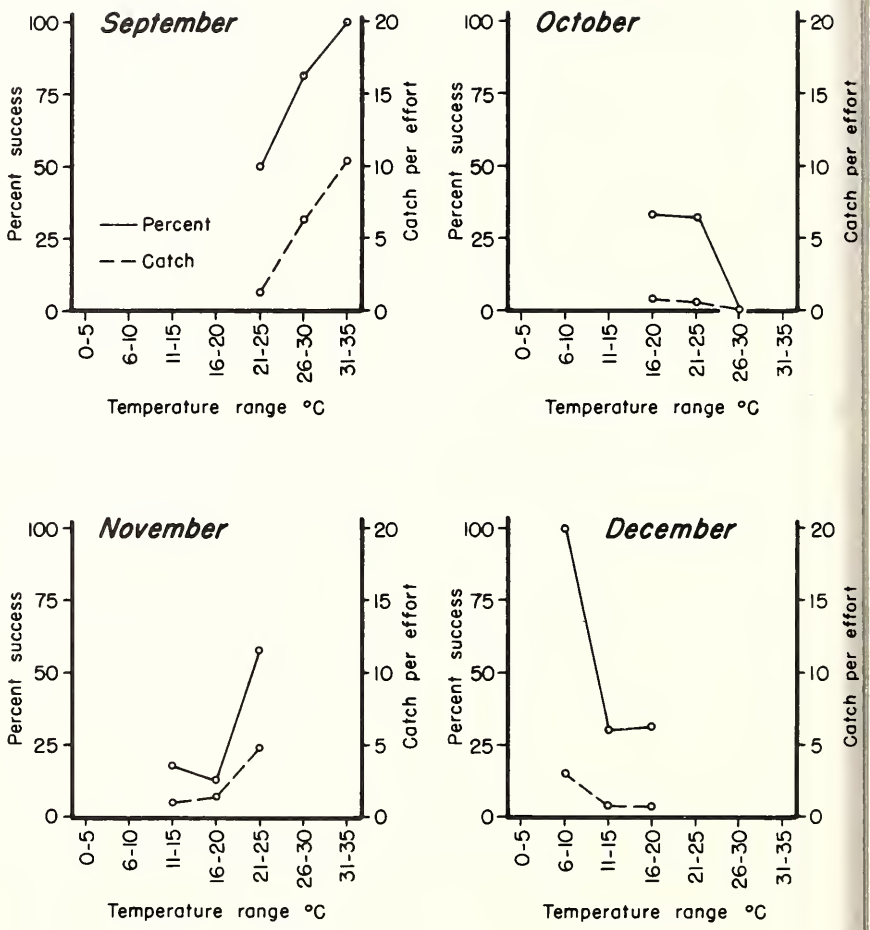


Figure 17. Trammel net catch showing the relative abundance of the Atlantic Croaker at various salinity ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Atlantic Croaker captured}}{\text{Total number of sets}}$$

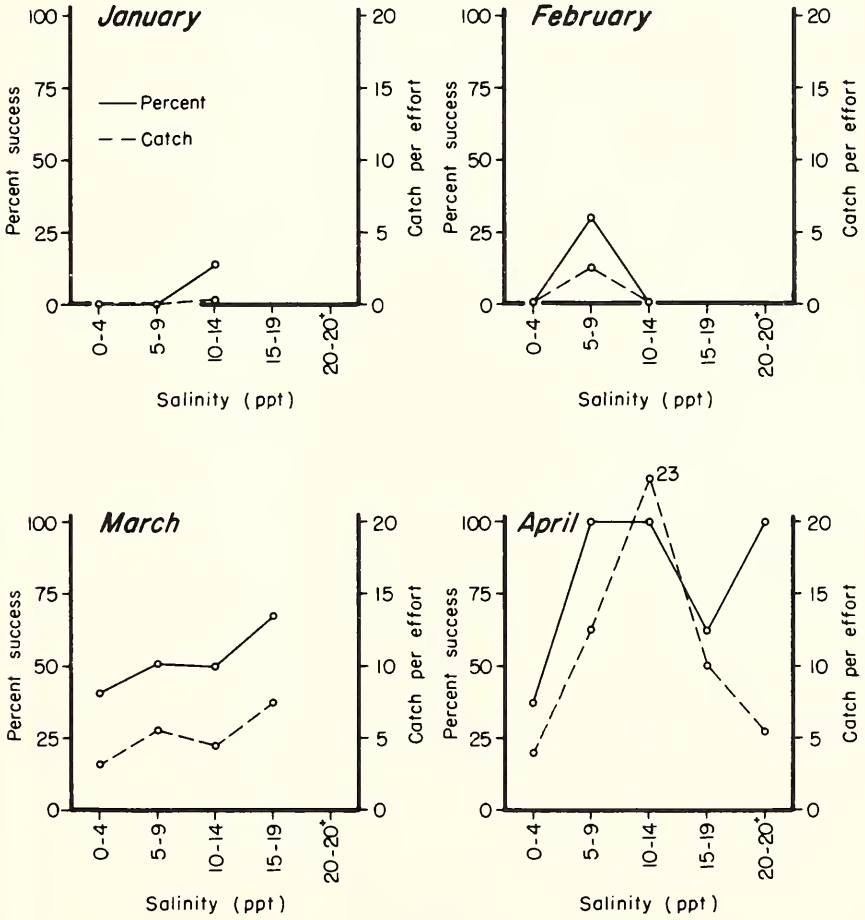


Figure 17. Atlantic Croaker, continued.

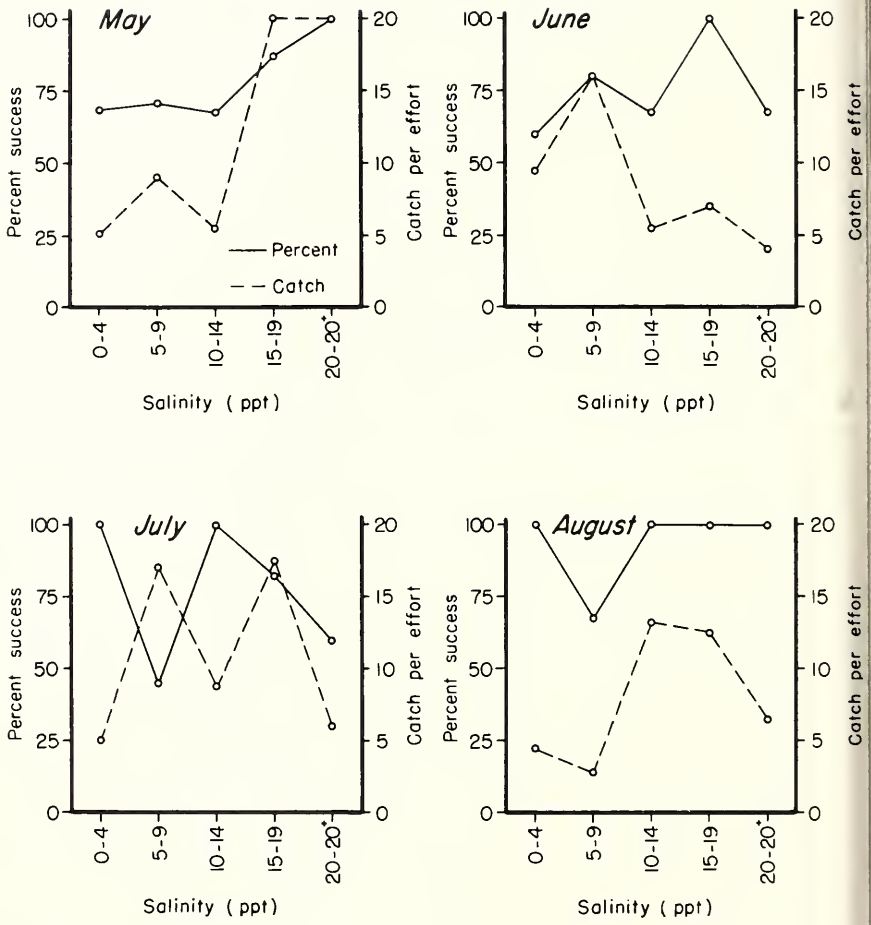
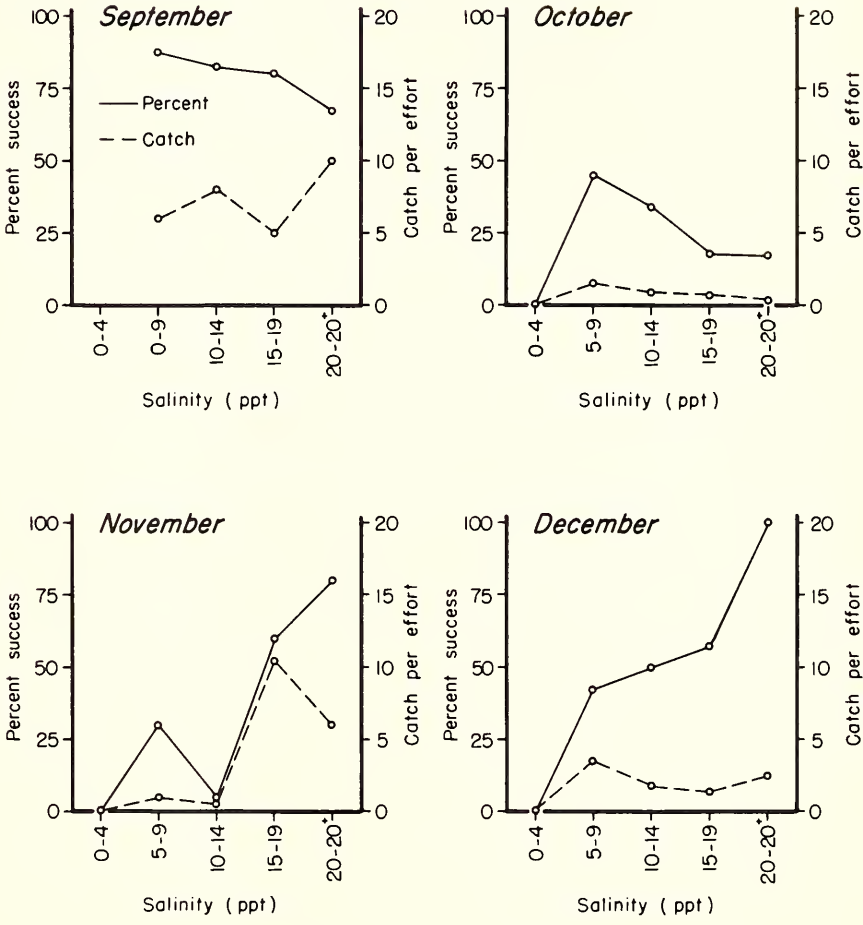


Figure 17. Atlantic Croaker, continued.



Tide and catch: No set pattern of success was observed when comparing sampling success to the various fluctuations of water levels. Successful catches often occurred during different tidal conditions in the same month, or catches would contrast themselves from one similar month to another when sampled under the same water level (Fig. 18).

Stomach analyses: One-hundred eighty-seven stomachs were examined; 132 contained food organisms; 55 were empty (Table 6).

The most important food items noted were small Rangia clams, young blue crabs, mud crabs, penaeid shrimp, bay anchovies and partially digested vegetation which appeared to be of the green algae type. It is not certain whether the plant food was eaten purposely or was ingested indirectly.

Gonadal analyses: Peak spawning occurred during September through November (Fig. 19). However, small numbers of atlantic croakers were found to be in the spawning condition during many other months of the year.

A wide temperature range, 15°C to 35°C was noted in which spawning occurred (Fig. 20).

Black drum, *Pogonias cromis*

Seasonal relative abundance and size distribution: The black drum population remained in the sampling area throughout the year. Peaks in catch per effort occurred during May, June, August, and December (Fig. 21).

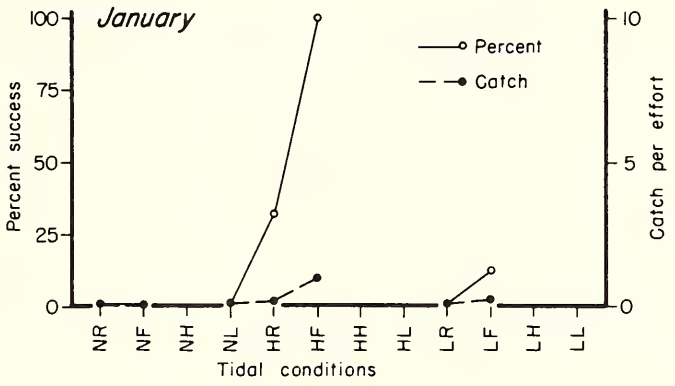
Figure 18. Trammel net catch showing the relative abundance of the Atlantic Croaker at various tidal conditions by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Atlantic Croaker captured}}{\text{Total number of sets}}$$

LEGEND-

NR = Normal, rising	HR = Prevailing high, rising	LR = Prevailing low, rising
NF = " , falling	HF = " " , falling	LF = " " , falling
NH = " , high ebb	HH = " " , high ebb	LH = " " , high ebb
NL = " , low ebb	HL = " " , low ebb	LL = " " , low ebb



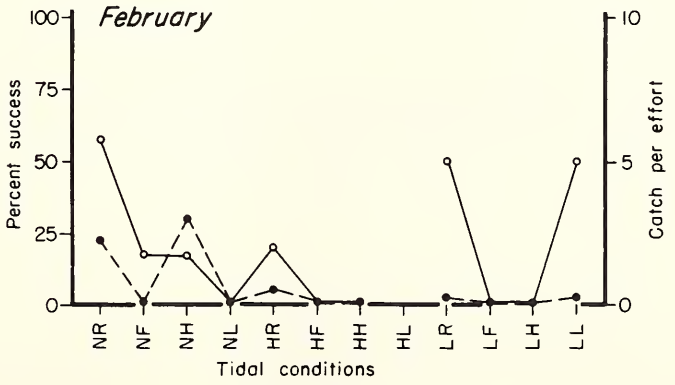


Figure 18. Atlantic Croaker, continued.

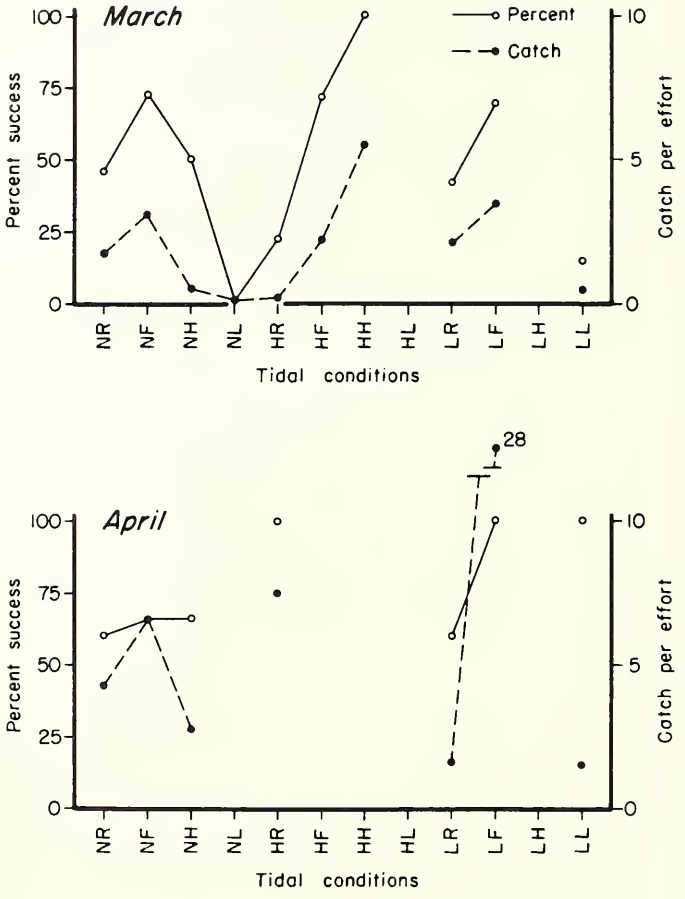


Figure 18. Atlantic Croaker, continued.

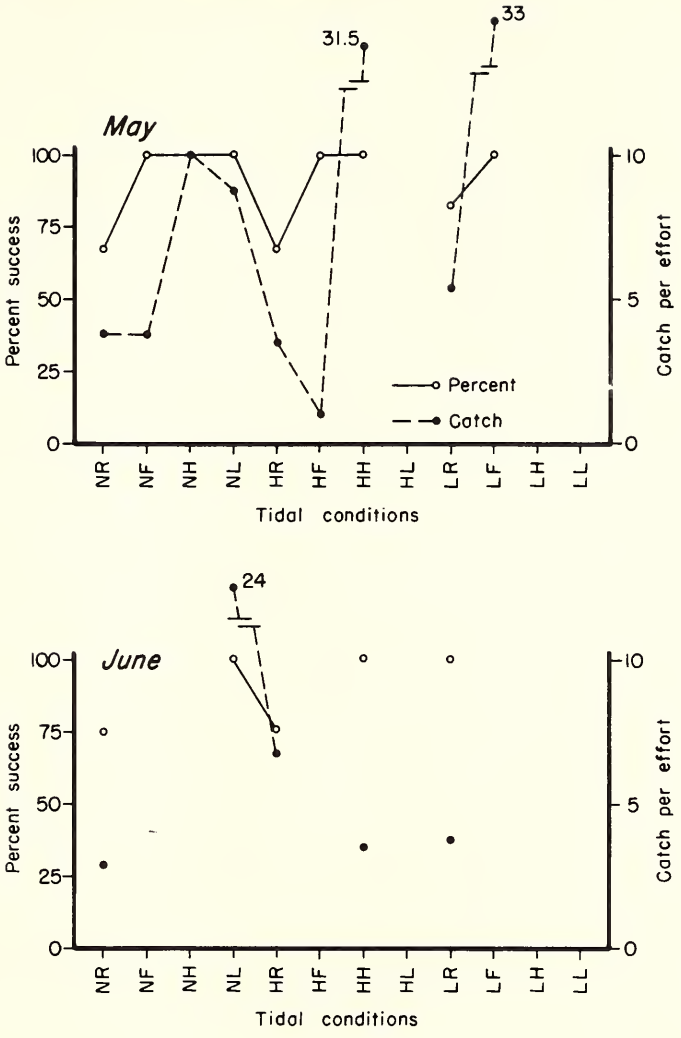


Figure 18. Atlantic Croaker, continued.

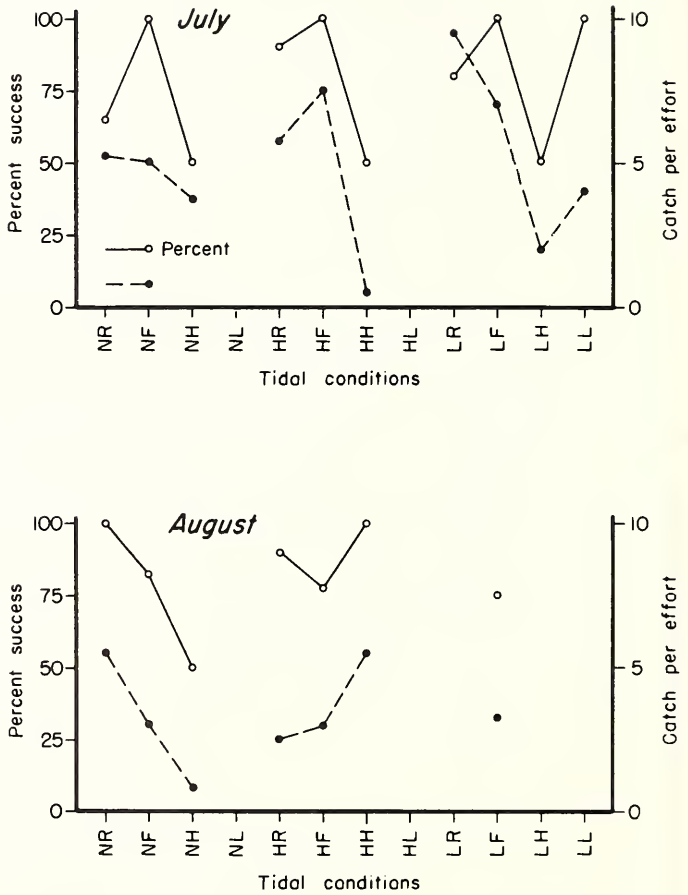


Figure 18. Atlantic Croaker, continued.

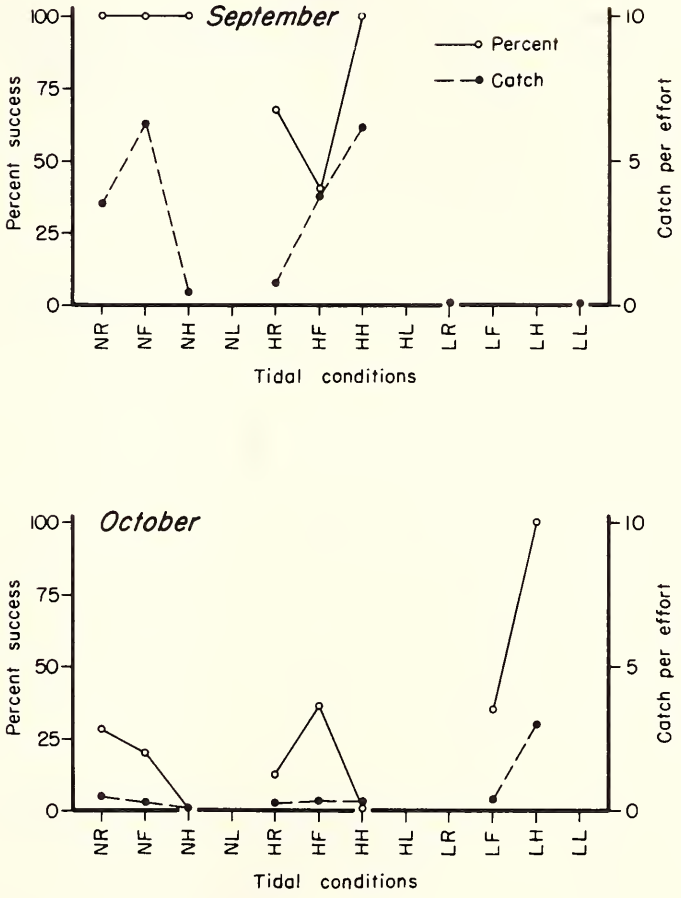


Figure 18. Atlantic Croaker, continued.

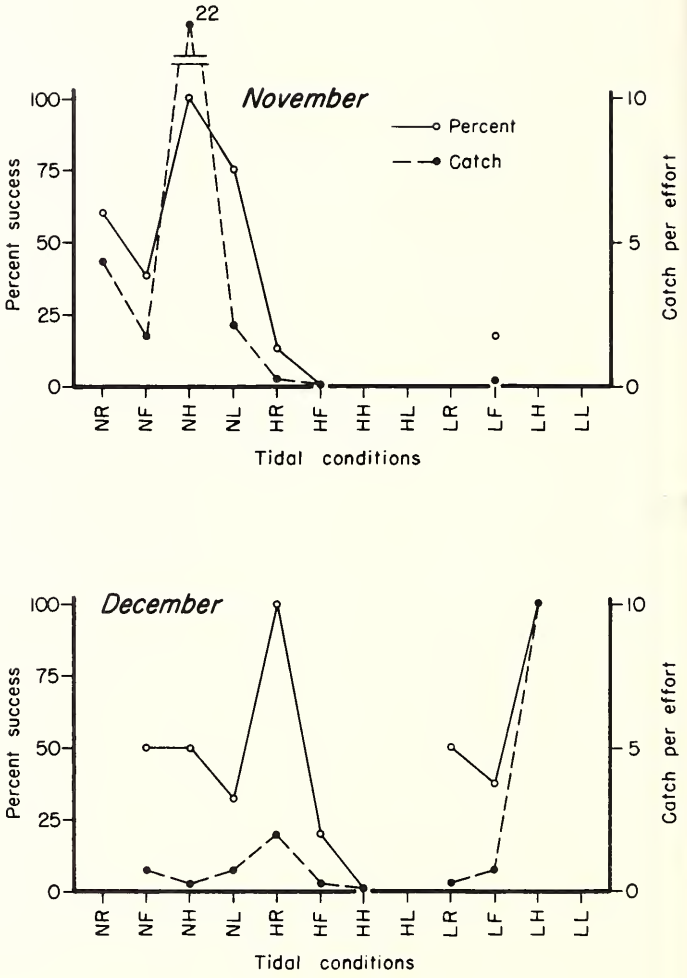


Table 6

Atlantic croaker stomach contents with number and percent occurrence of stomach containing them. 187 stomachs examined; 132 contained food; 55 empty

Stomach Contents	*No. stomachs*	*% Occurrence*
Pelycypoda	*40*	*30.3*
clam shells, mostly *Rangia sp.*	40	30.3
Polychaeta	*1*	*1.5*
Errantia		
clam worm	1	1.5
Crustacea	*46*	*34.8*
Isopoda		
Cymothoidae		
Isopod	1	0.7
Decapoda		
Penaeidae		
Penaeid shrimp	7	5.3
Palemonidae		
Grass shrimp	2	1.5
Portunidae		
Blue crab (small)	6	4.5
Unidentifiable (Partially digested mixture which appeared to be that of small blue crabs and some mud crabs)	30	22.7
Osteichthyes	*35*	*26.5*
Clupeiformes		
Engraulidae		
Bay anchovy	2	1.5
Unidentifiable	33	25.0
Animal matter (unidentifiable)	*15*	*11.4*
Vegetation (Partially digested)	*37*	*28.0*

Figure 19. Percent occurrence of Atlantic Croaker's gonadal condition by month for period 1960-68, combining all stations.

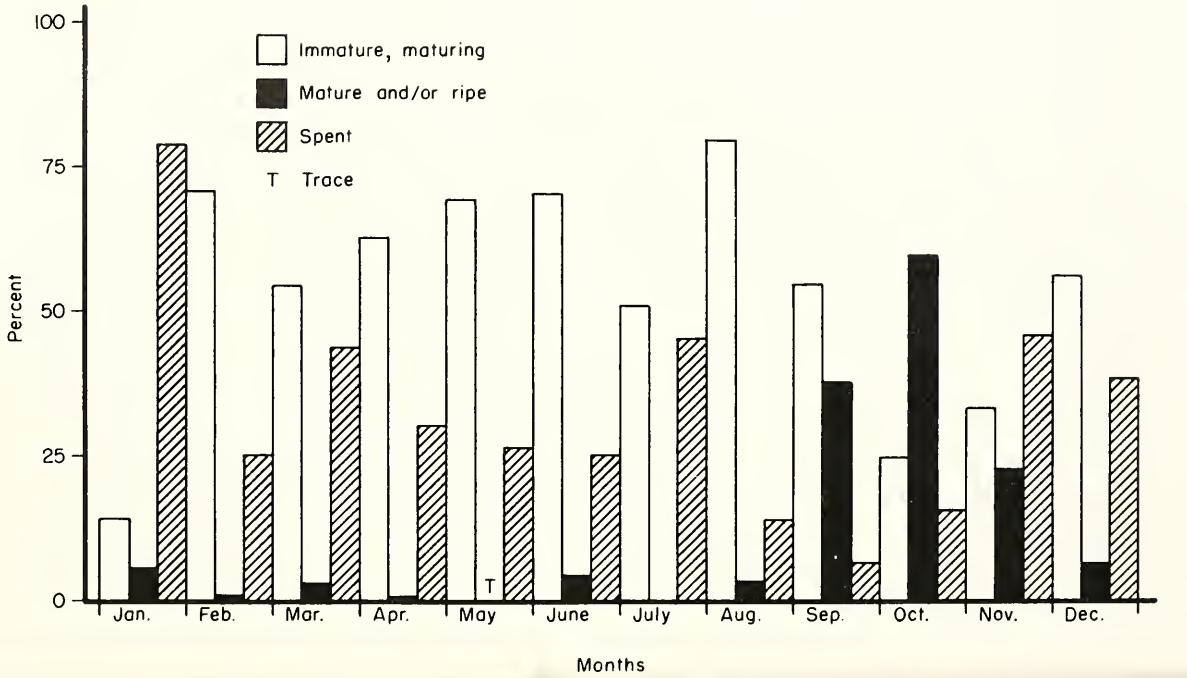


Figure 20. Percent occurrence of Atlantic Croaker's gonadal condition at various temperature ranges for period 1960-68, combining all stations.

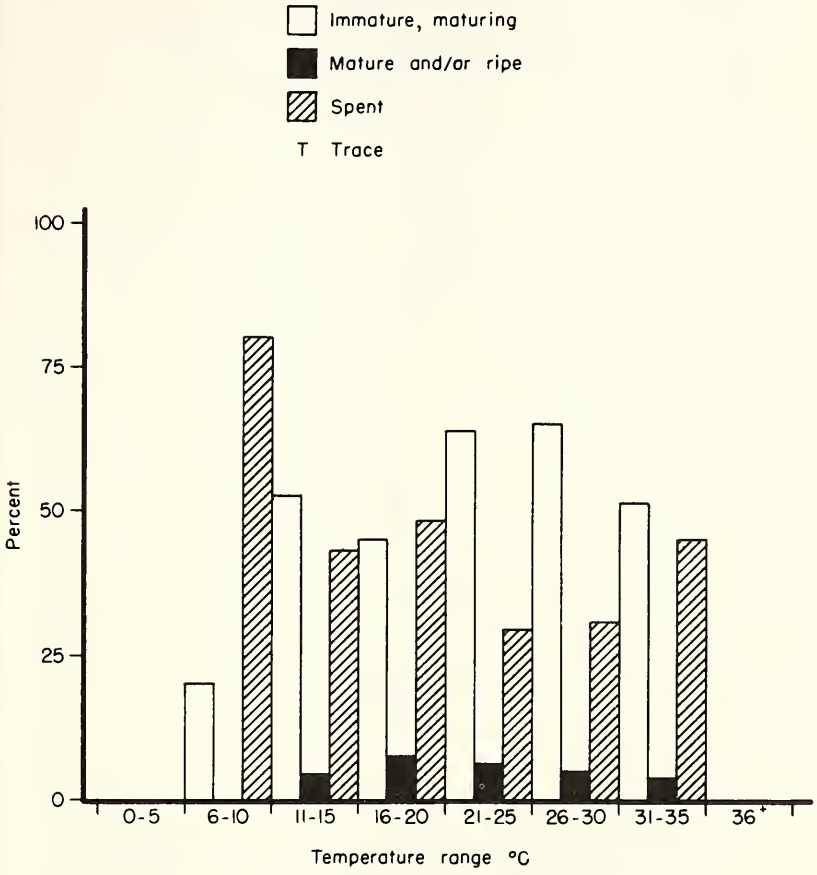
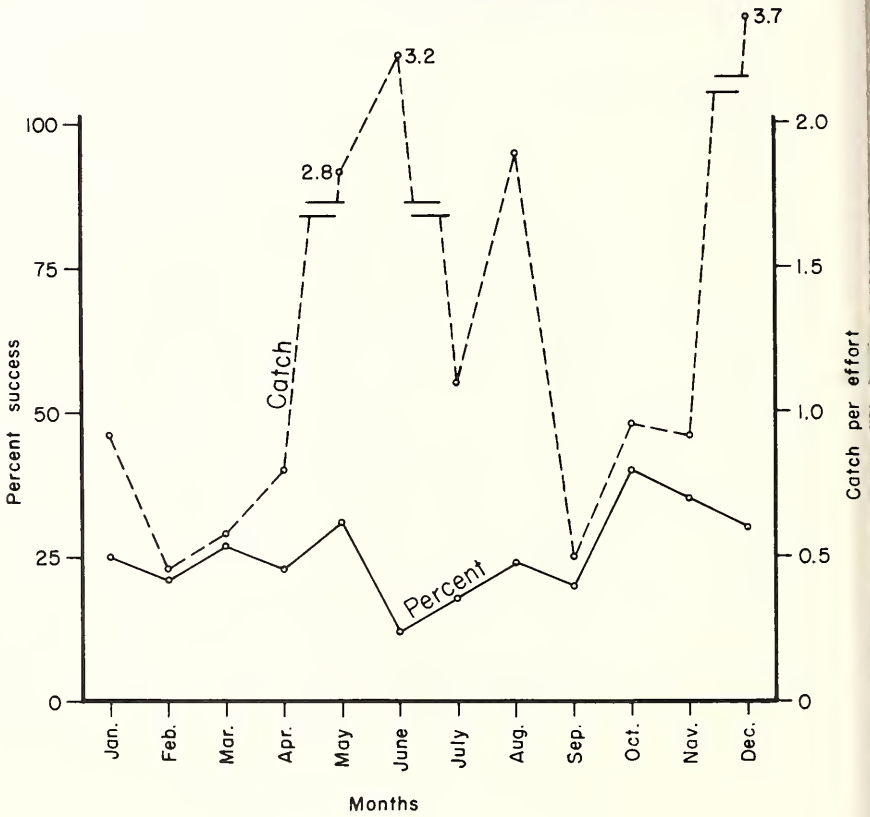


Figure 21. Trammel net catch showing relative monthly abundance of the Black Drum combining catch from all stations for the period 1960 - 68.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Black Drum captured}}{\text{Total number of sets}}$$



Black drums weighing from less than .5 pounds to 1.5 pounds composed approximately 62 percent of the population sampled (Fig. 22) and were in the six inch to twelve inch class category (Fig. 23). The largest black drum collected weighed approximately fifty pounds.

Movement data from tagging returns are shown in Table 4.

Temperature and catch: Overall, catch was generally greater during temperature range 21°C to 30°C. Above or below this range, catch tended to decrease (Fig. 24). On a monthly analysis, this held true during January through July, afterwhich, exceptions occurred (Fig. 25).

Salinity and catch: No set pattern of success was observed when comparing sampling success to the various salinity ranges sampled (Fig. 26). Generally, catches were small or nil when sampling occurred in waters below 5 ppt. Outstanding peaks occurred in May during salinities above 20 ppt, and during salinity range 15-20 ppt in the months of July, October and December.

Tide and catch: Like salinity, no set pattern of success was observed when comparing sampling success to the various tidal conditions (Fig. 27). However, outstanding peaks in catch occurred in March and May during the prevailing high-high ebb condition, and in September during the normal-rising condition.

Stomach analysis: One hundred nine stomachs were examined; 81 contained food; 28 were empty (Table 7).

Table 7
Black drum stomach contents with number and percent occurrence of stomach containing them. 109 stomachs examined; 81 contained food; 28 empty

Stomach contents	*No. Stomachs*	*% Occurrence*
Pelycypoda	*31*	*38.3*
Clam and/or oyster shells	31	38.3
Polychaeta	*8*	*9.8*
Errantia		
Clam worm	8	9.8
Crustacea	*31*	*38.2*
Isopod	1	1.2

Stomach contents	*No. Stomachs*	*% Occurrence*
Gammaridae		
Isopod	*1*	*1.2*
Decapoda		
Penaeidae		
Penaeid shrimp	2	2.5
Palaemonidae		
Grass shrimp	2	2.5
Portunidae		
Blue crab	13	16.0
Unidentifiable		
(Partially digested crab species)	13	16.0
Insecta (Unidentifiable partially digested Insect species)	*2*	*2.5*
Osteichthyes	*13*	
Anguilliformes		
Ophichthidae		
Snake eel species	1	1.2
Cyprinodontiformes		
Syngnathidae		
Pipefish species	1	1.2
Tetraodontiformes		
Tetraodontidae		
Southern puffer	4	4.9
Unidentifiable (skeleton appeared to be snake eel sp.)	7	6.4
Animal Matter (unidentifiable)	*16*	*19.7*
Vegetation	*17*	*21.0*

The most important food items noted were clam (Rangia) and oysters, *Crassostrea virginica*, blue crabs, *Callinectes sapidus*, snake eel species and vegetation (partially digested green algae type). It is not certain if the plant food was eaten purposely or indirectly.

Figure 22. Percent occurrence of various weights of the Black Drum captured during the period 1960-1968, combining all stations.

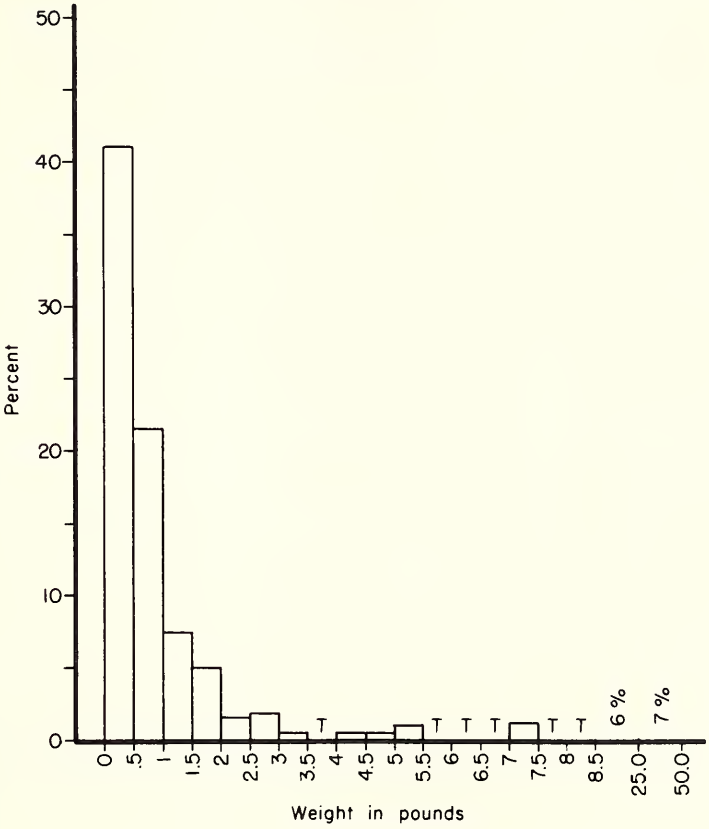


Figure 23. Percent occurrence of various lengths of the Black Drum captured during the period 1960 - 1968, combining all stations.

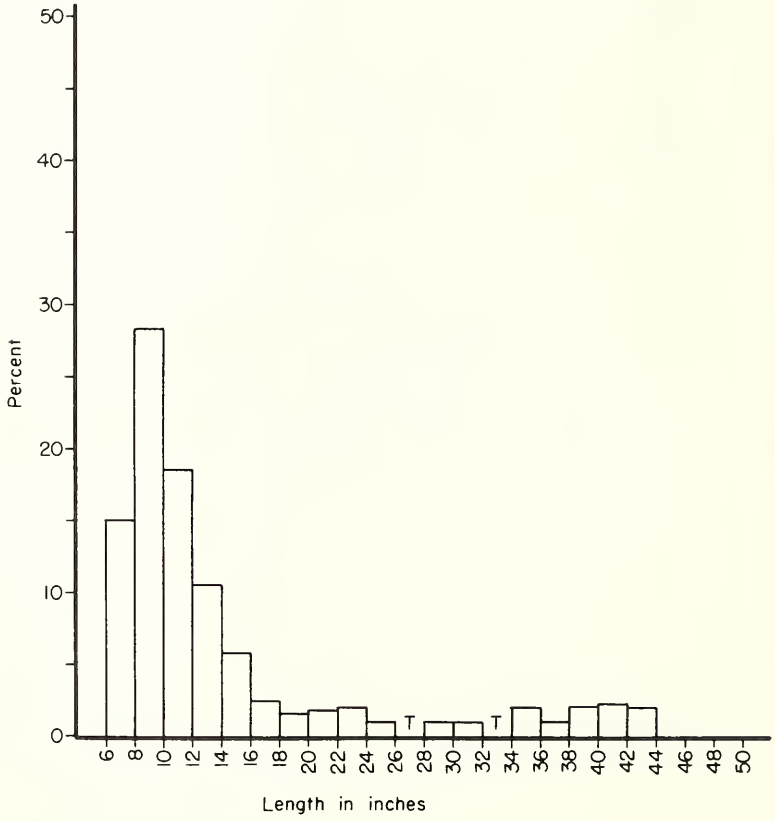


Figure 24. Trammel net catch showing the relative abundance of the Black Drum at various temperature ranges which occured during the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Black Drum captured}}{\text{Total number of sets}}$$

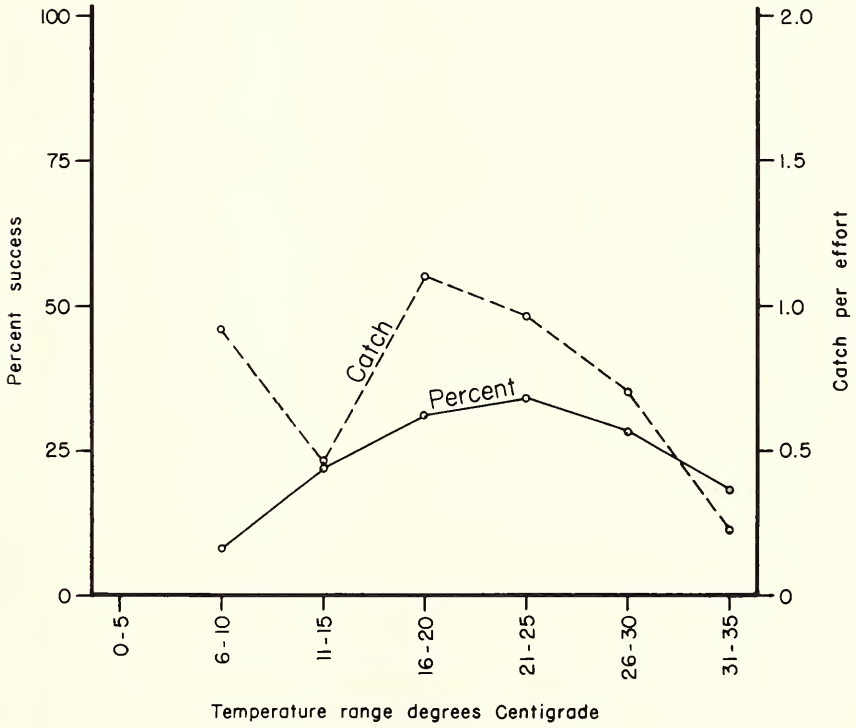


Figure 25. Trammel net catch showing the relative abundance of the Black Drum at various temperature ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Black Drum captured}}{\text{Total number of sets}}$$

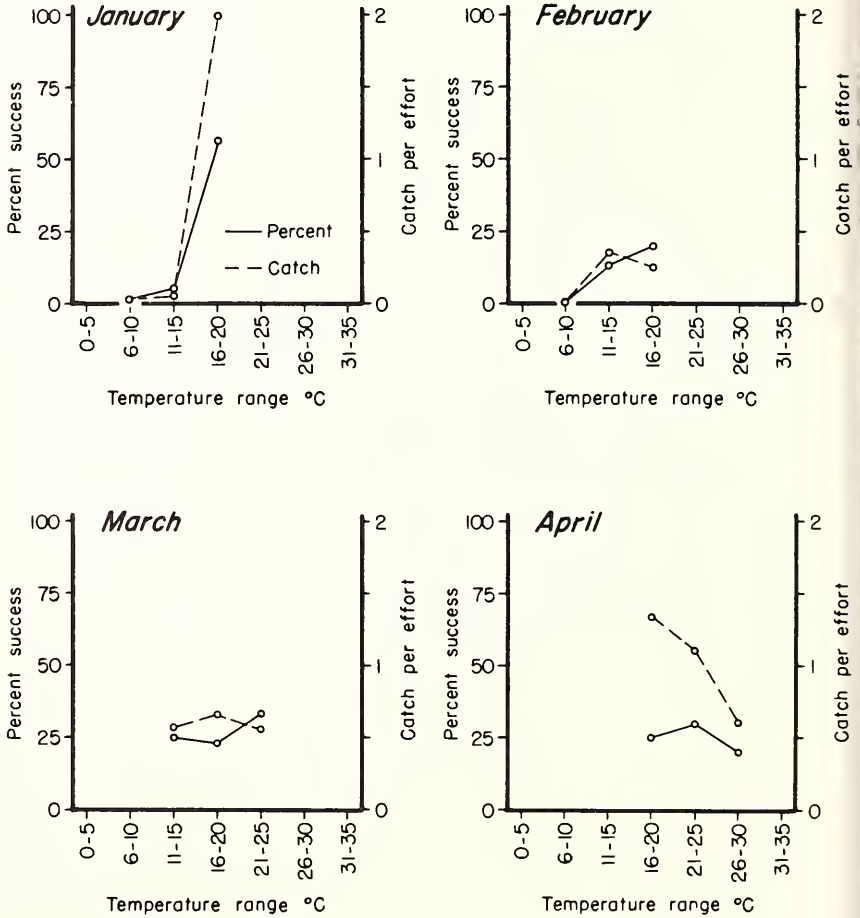


Figure 25. Black Drum, continued.

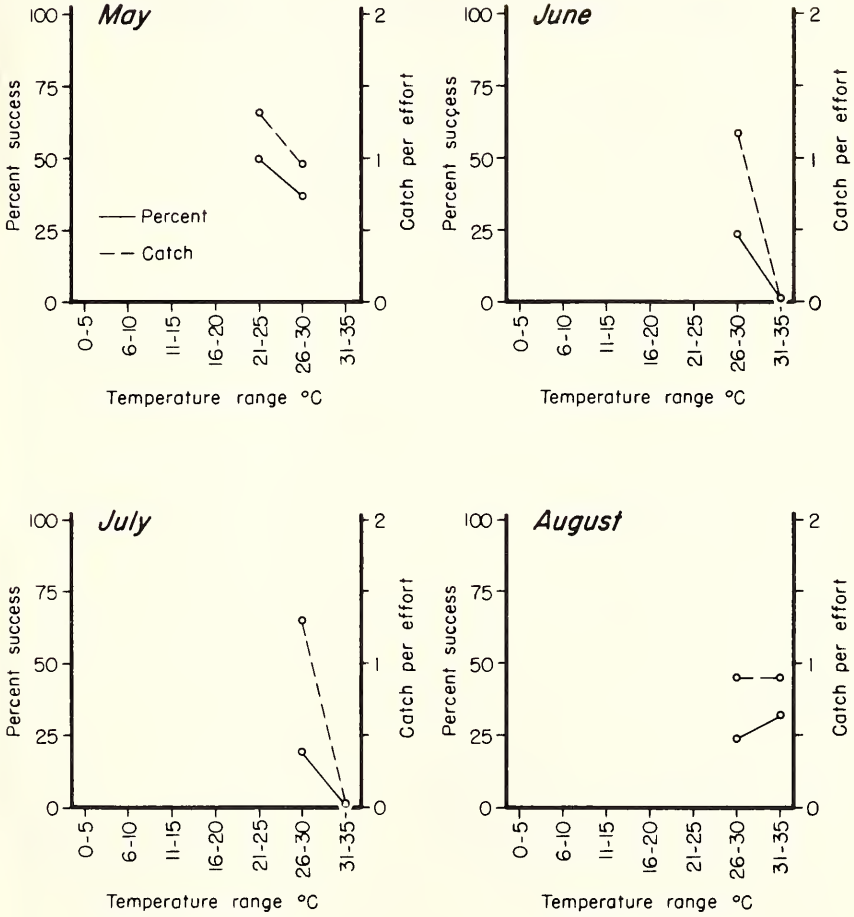


Figure 25. Black Drum, continued.

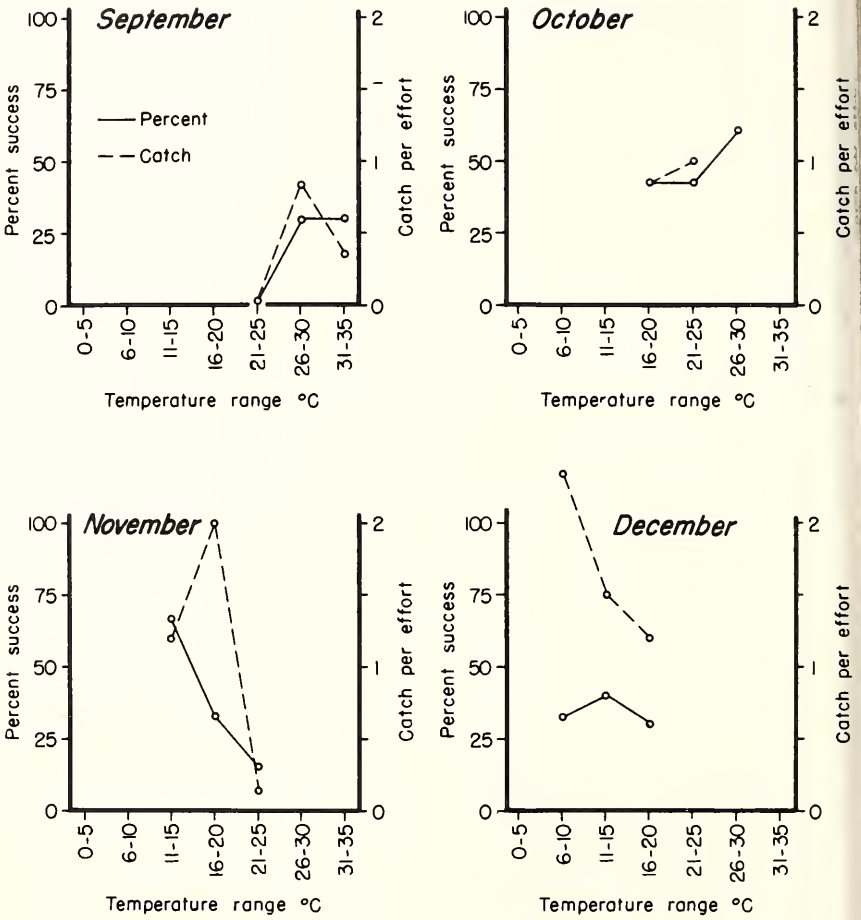


Figure 26. Trammel net catch showing the relative abundance of the Black Drum at various salinity ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Black Drum captured}}{\text{Total number of sets}}$$

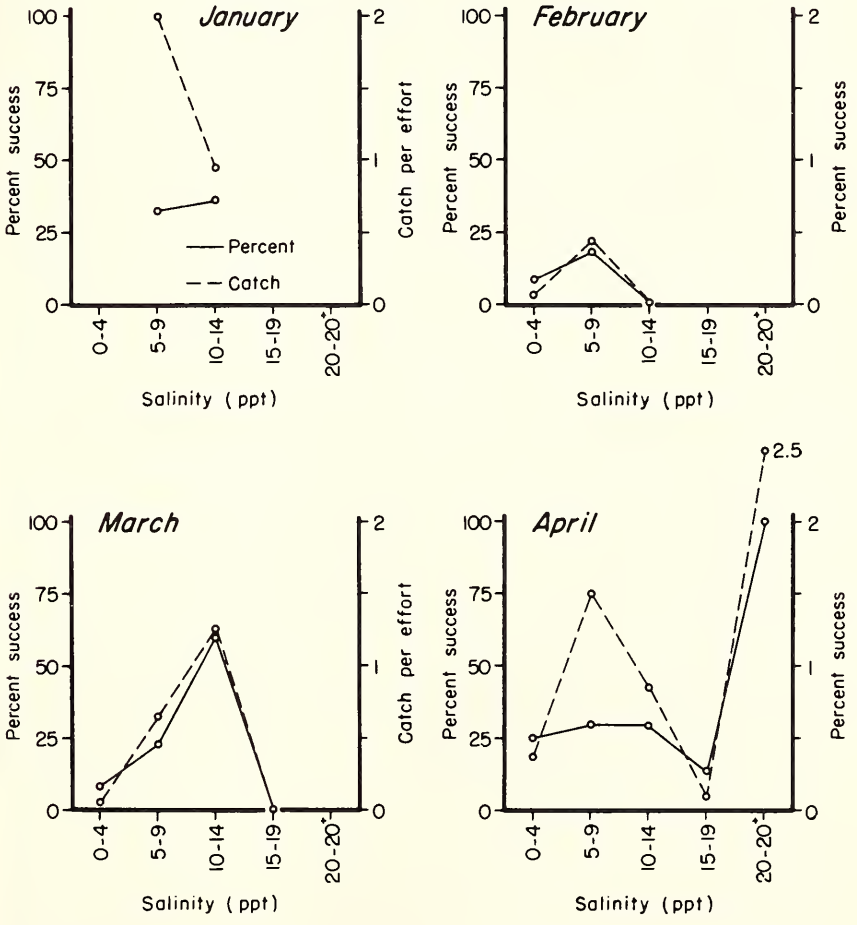


Figure 26. Black Drum, continued.

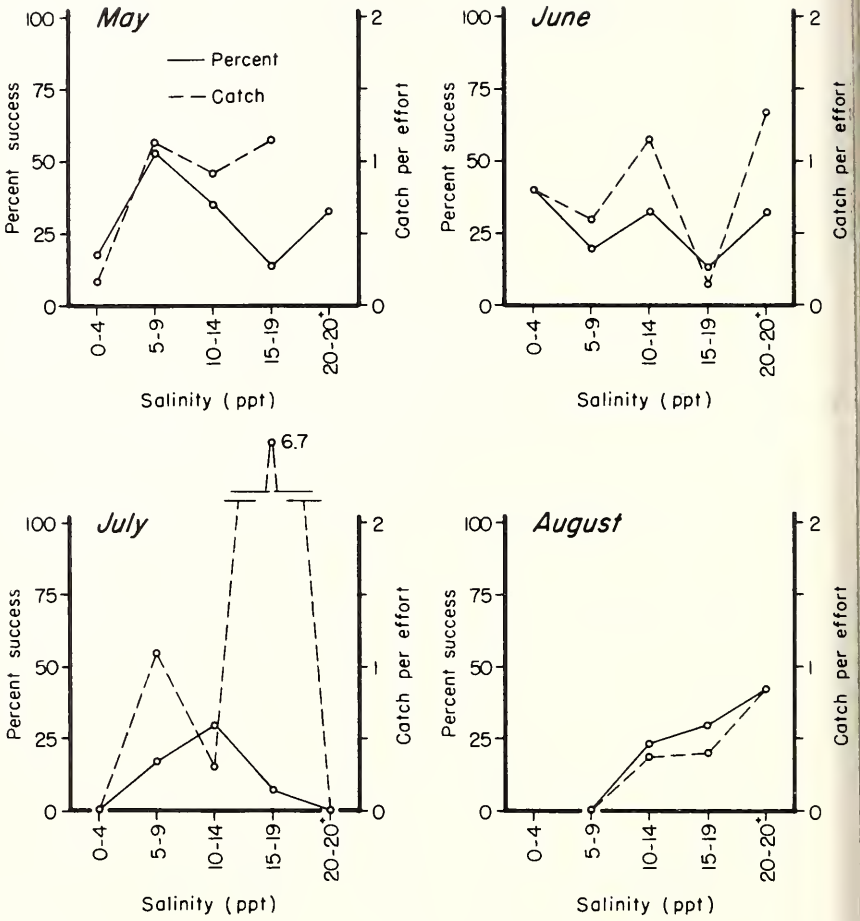


Figure 26. Black Drum, continued.

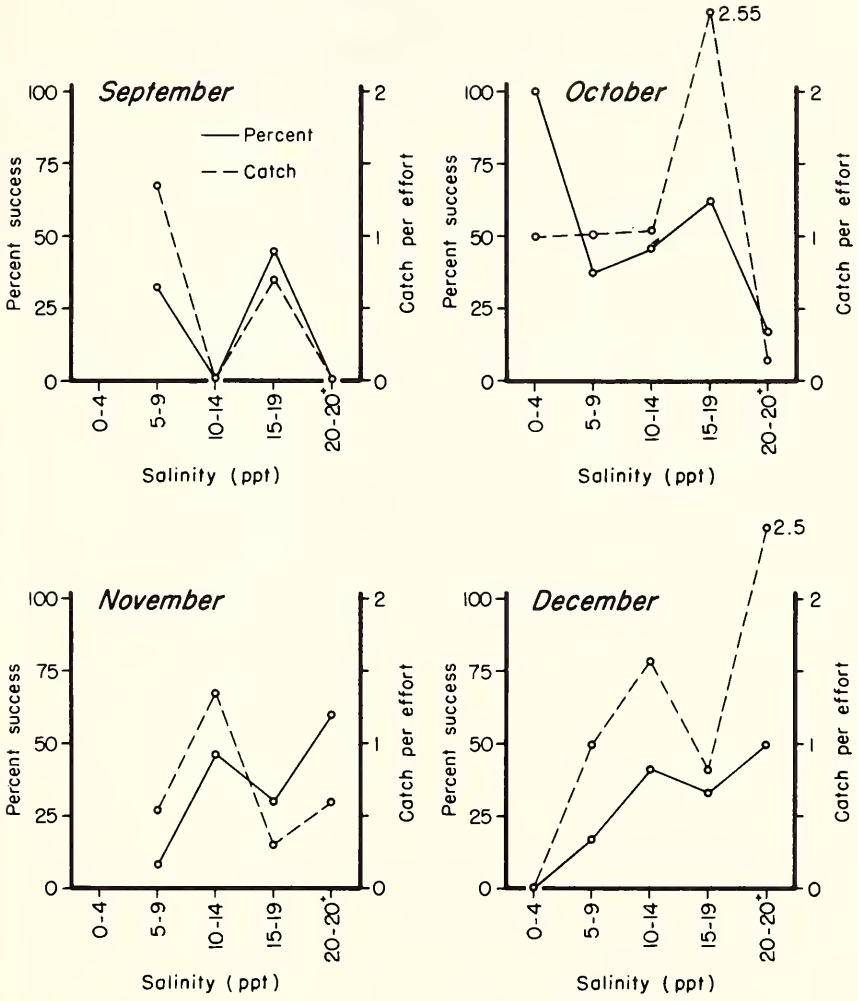


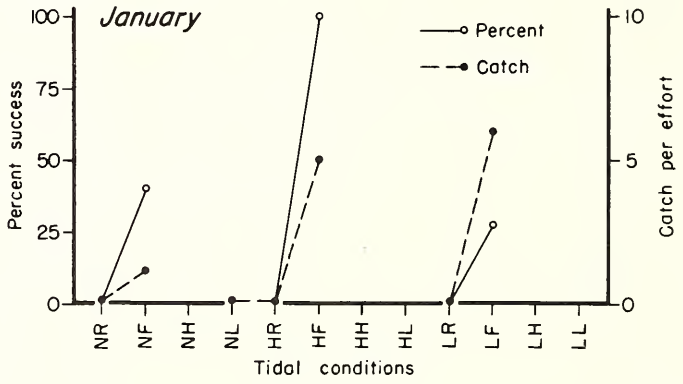
Figure 27. Trammel net catch showing the relative abundance of the Black Drum at various tidal conditions by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Black Drum captured}}{\text{Total number of sets}}$$

LEGEND–

NR = Normal, rising	HR = Prevailing high, rising	LR = Prevailing low, rising
NF = " , falling	HF = " " , falling	LF = " " , falling
NH = " , high ebb	HH = " " , high ebb	LH = " " , high ebb
NL = " , low ebb	HL = " " , low ebb	LL = " " , low ebb



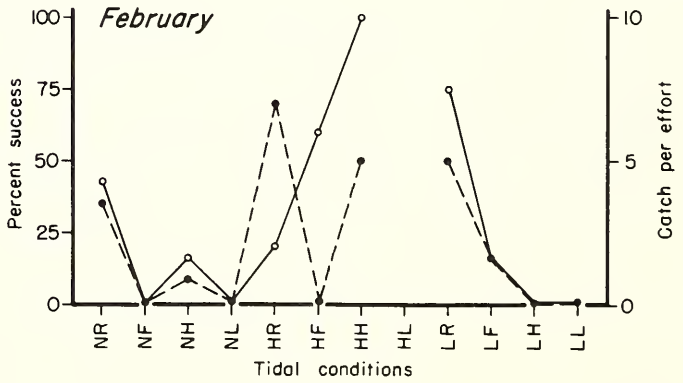


Figure 27. Black Drum, continued.

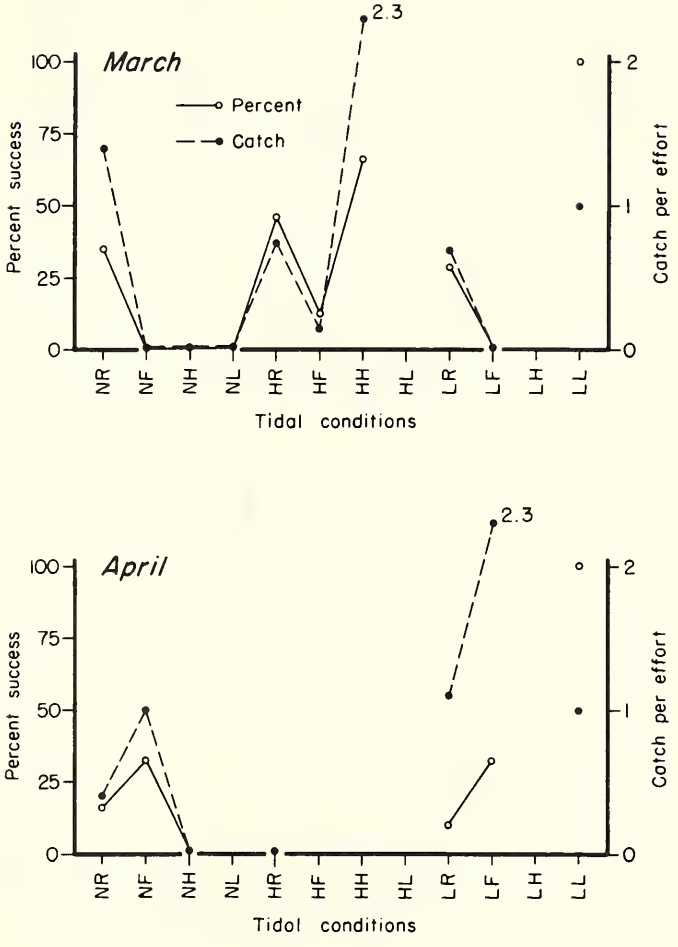


Figure 27. Black Drum, continued.

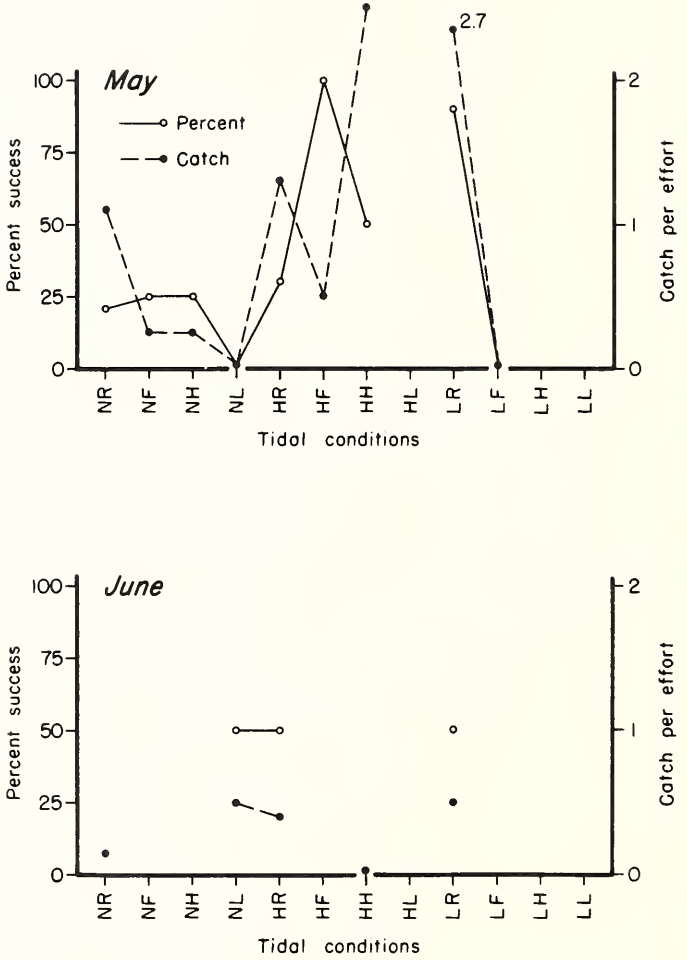


Figure 27. Black Drum, continued.

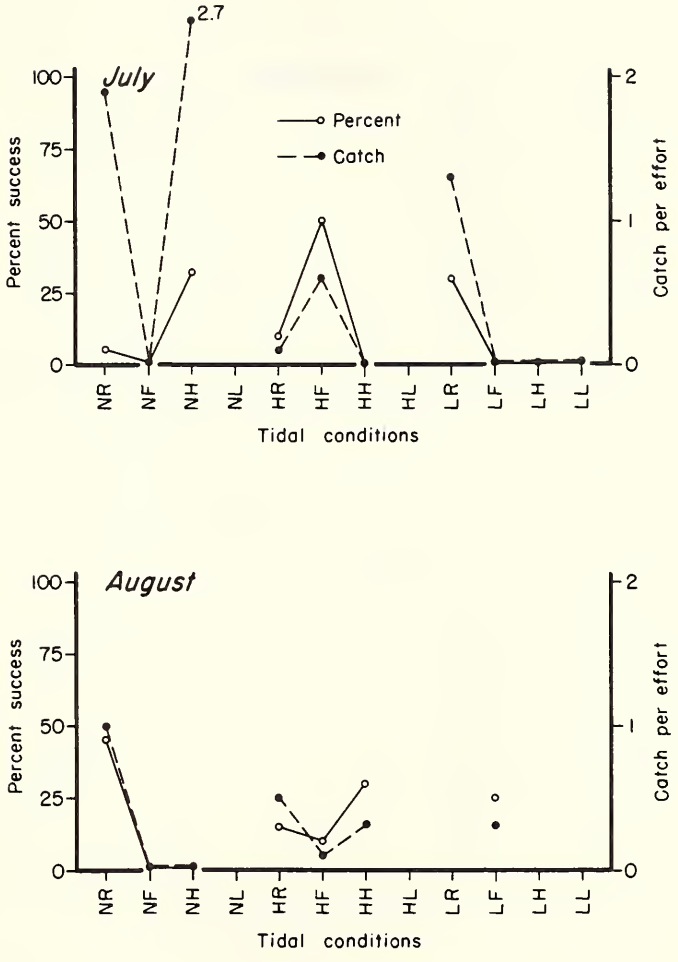


Figure 27. Black Drum, continued.

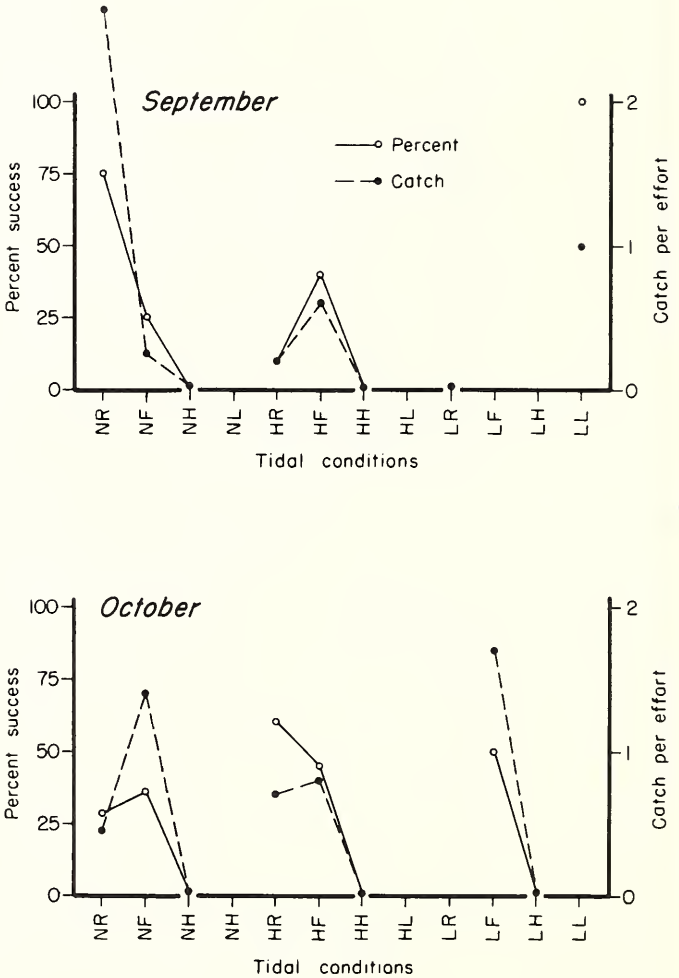
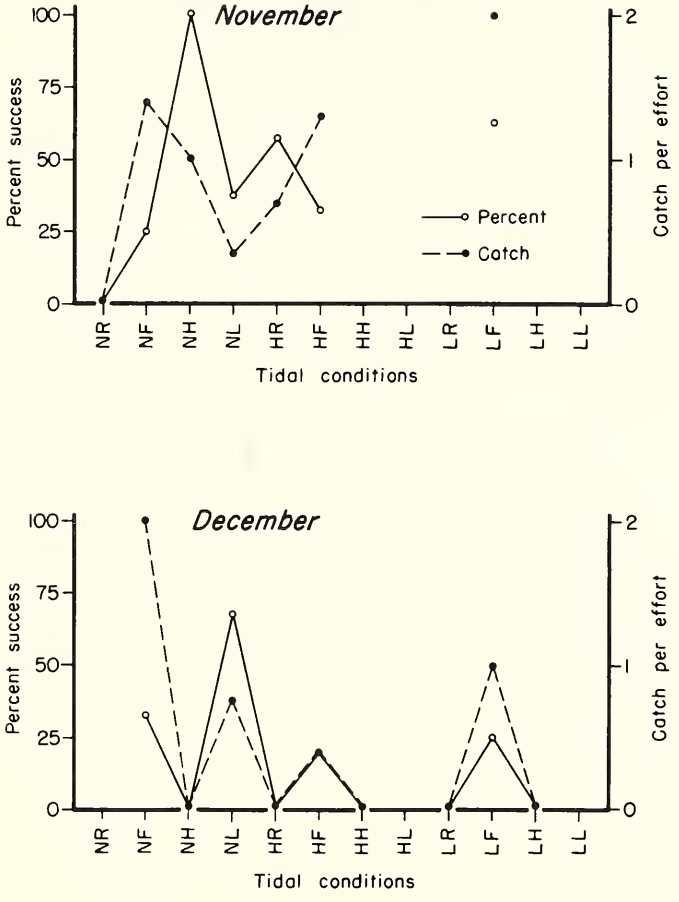


Figure 27. Black Drum, continued.



The favorite natural bait used in fishing the black drum in the study area were *Penaeus* shrimp and small to medium blue crabs.

Gonadal analyses: Peak spawning occurred during March, April and May (Fig. 28). Very little spawning appeared to occur during any other period.

The temperature range recorded during spawning was 16° C to 25° C (Fig. 29).

Red drum, *Sciaenops occellata*

Seasonal relative abundance and size distribution: Red drum were collected during every month of the year. Peaks in catch per effort occurred during the fall, early winter and the month of March (Fig. 30).

Red drum weighing from 1 to 2.5 pounds composed approximately 57 percent of the catch (Fig. 31) and were in the 14 to 20 inch class (Fig. 32). One's chances of catching large red drum weighing over ten pounds was greater during the months of April and November (Fig. 33). The largest red drum collected weighed 23 pounds.

Movement data from tagging returns is shown in Table 4.

Temperature and catch: An analysis of catch versus water temperature indicated that the red drum was more prevalent during temperature range 11° C to 30° C and that overall, little variation of catch occurred in this range (Fig. 34). Unlike the atlantic croaker, catches of red drum decreased as water temperatures increased above 30° C.

Figure 28. Percent occurrence of Black Drum's gonadal condition by month for period 1960-68, combining all stations.

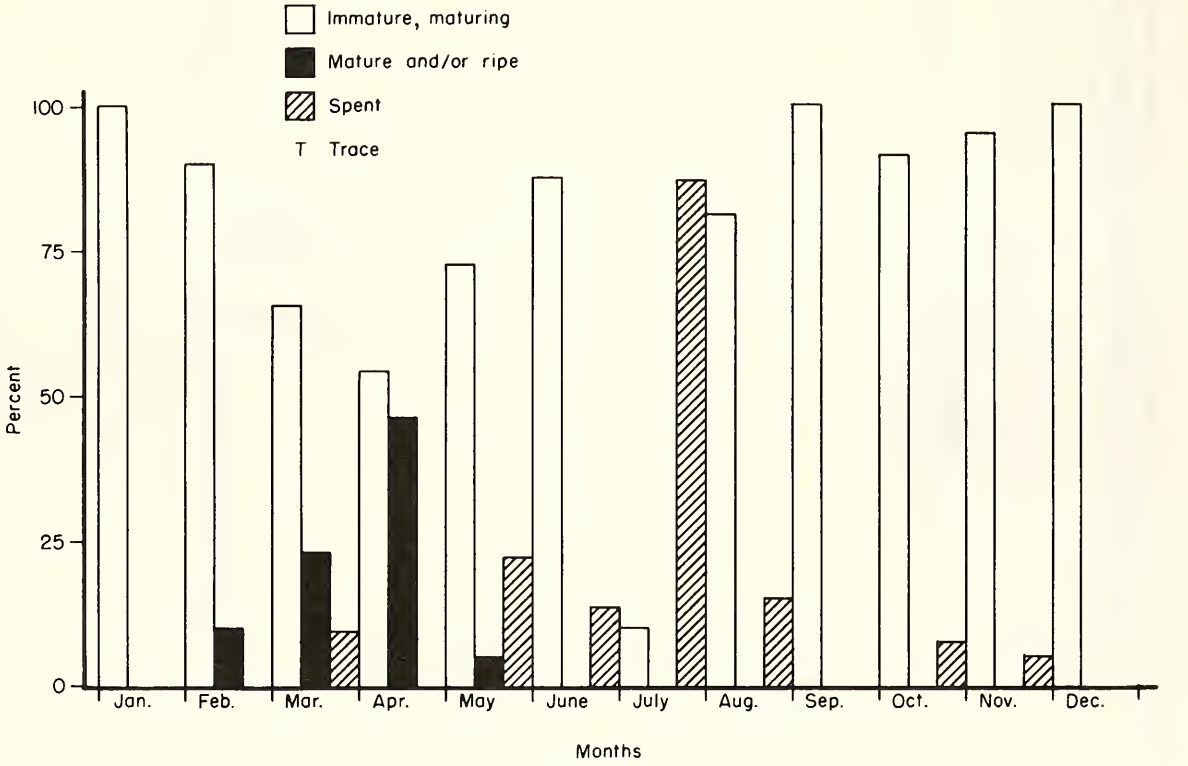


Figure 29. Percent occurrence of Black Drum's gonadal condition at various temperature ranges for period 1960-68, combining all stations.

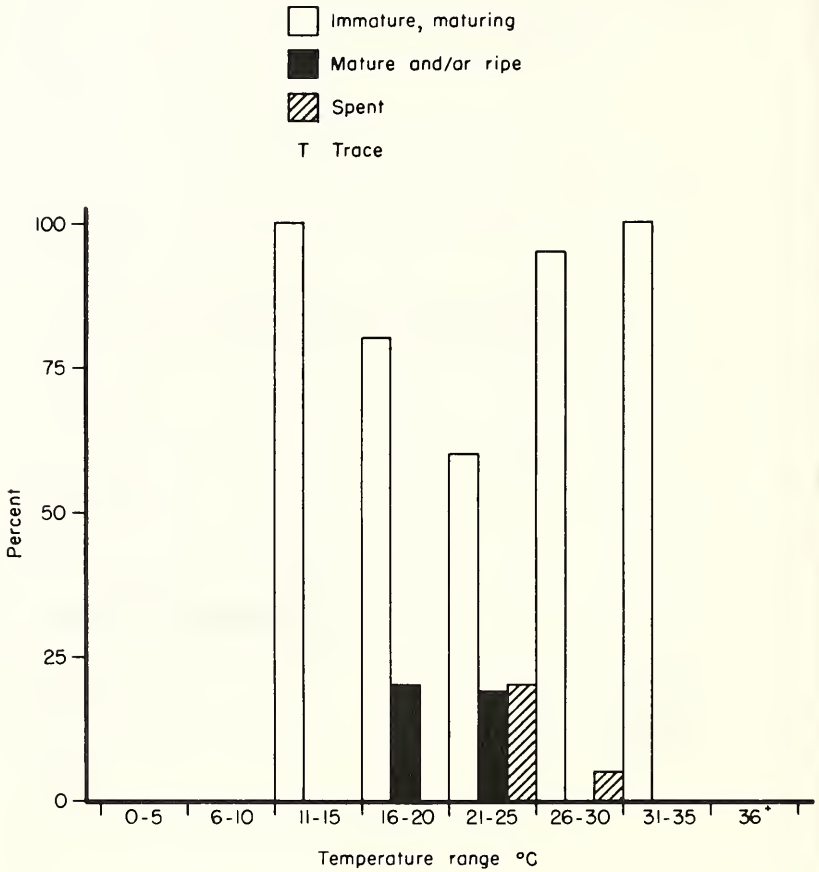


Figure 30. Trammel net catch showing relative monthly abundance of the Red Drum combining catch from all stations for the period 1960-68.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Red Drum captured}}{\text{Total number of sets}}$$

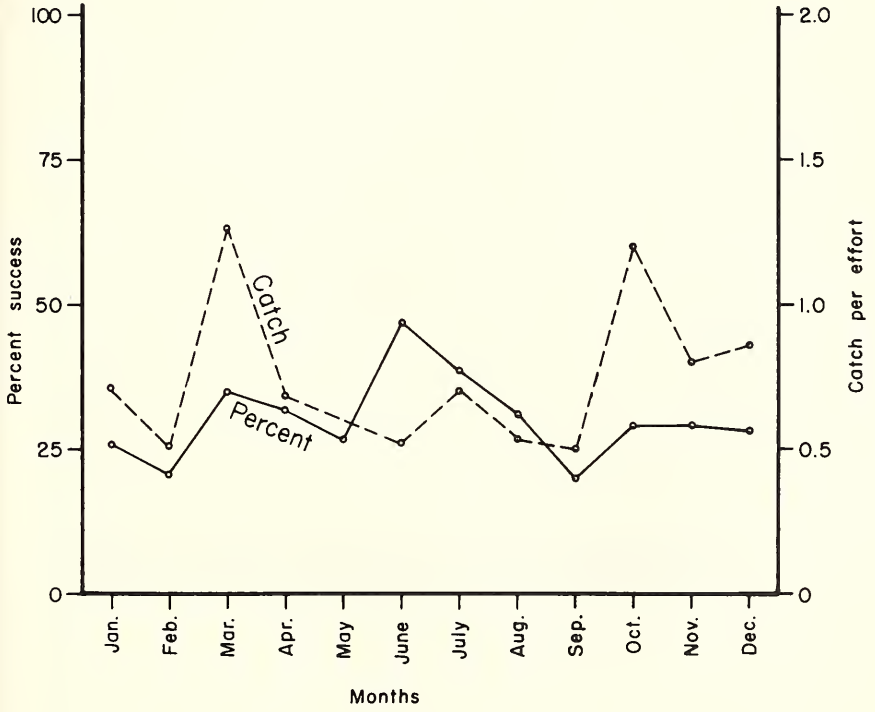


Figure 31. Percent occurrence of various weights of the Red Drum captured during the period 1960 - 1968, combining all stations.

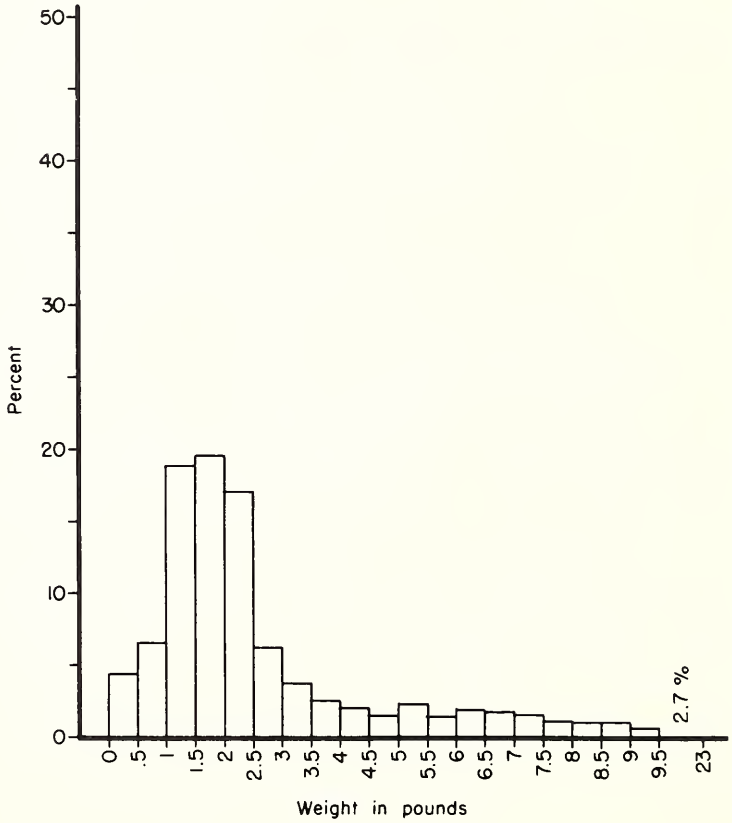


Figure 32. Percent occurrence of various lengths of the Red Drum captured during the period 1960 - 1968, combining all stations.

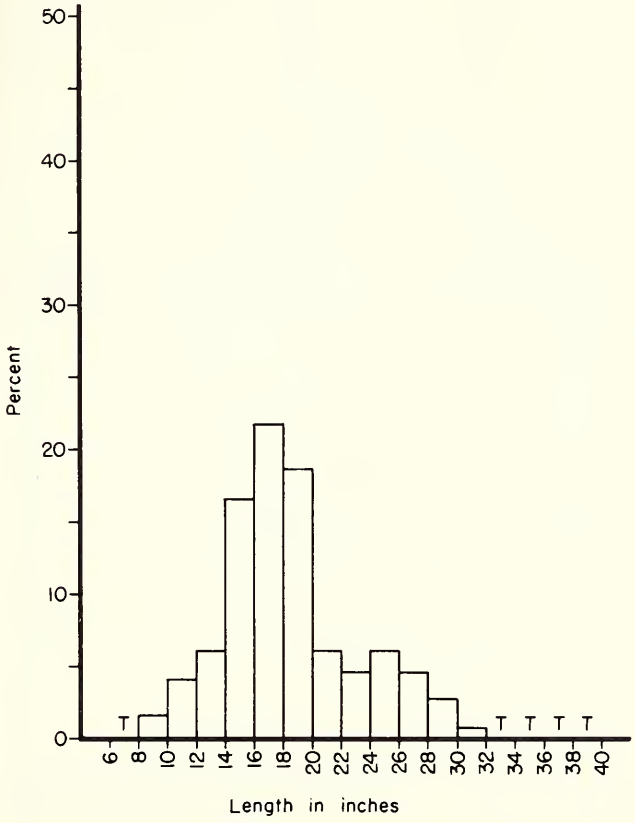


Figure 33. Percent occurrence of various weights by months of the Red Drum captured during the period 1960-1968, combining all statior

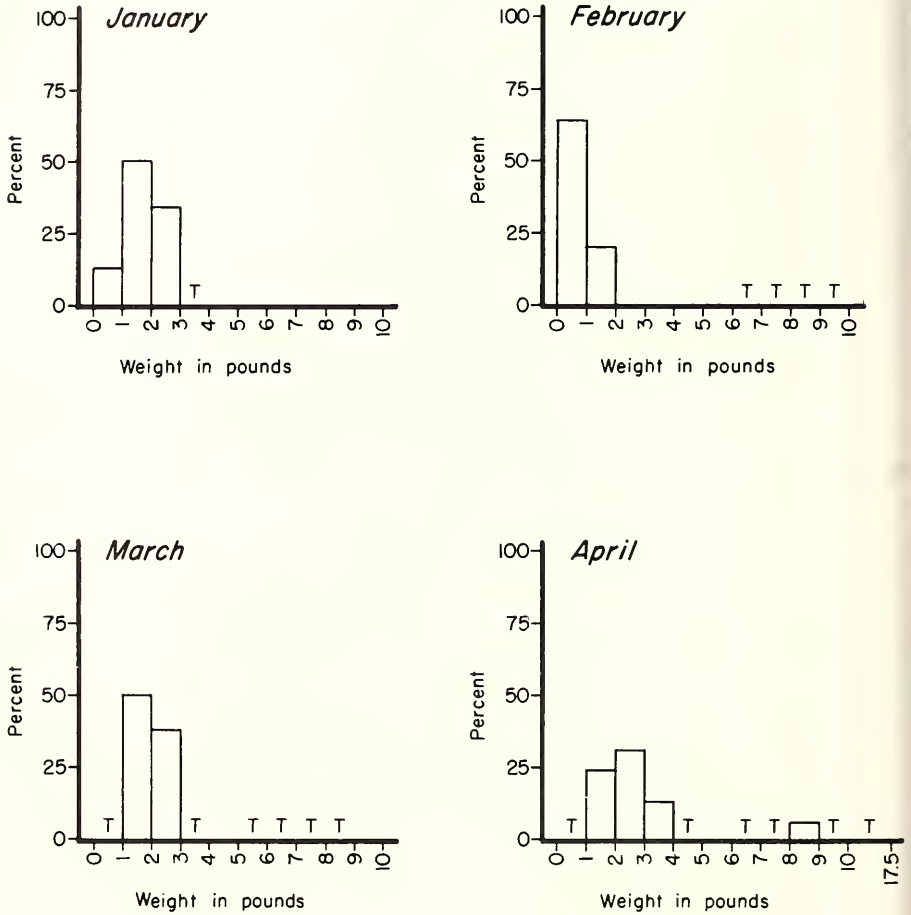


Figure 33. Red Drum, continued.

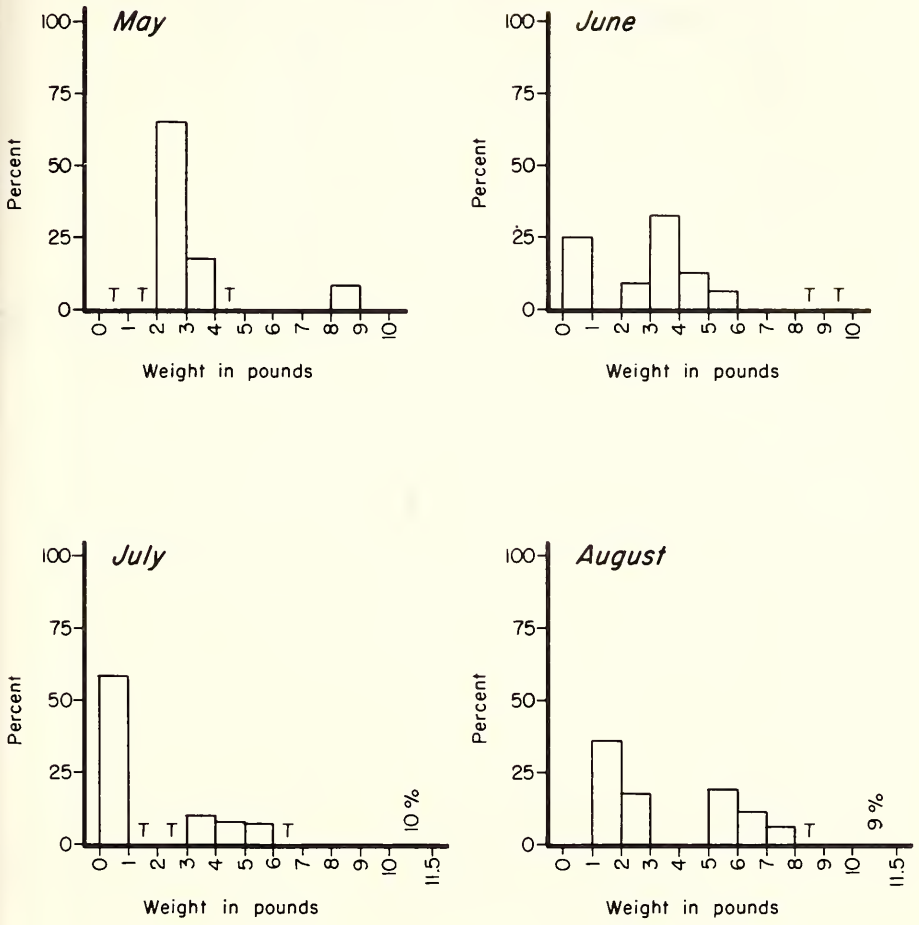
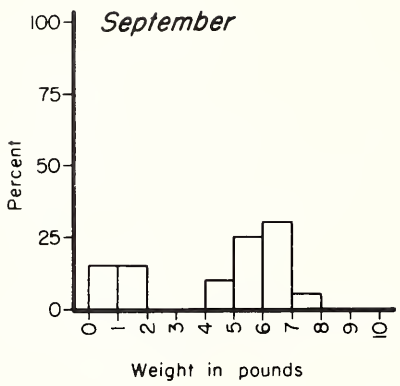
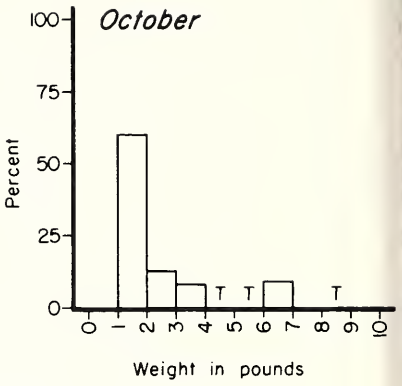
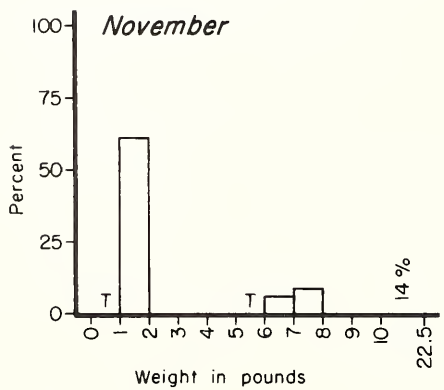


Figure 33. Red Drum, continued.







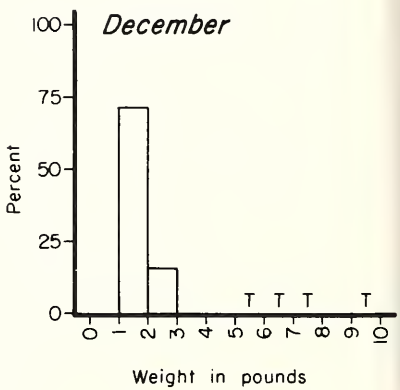
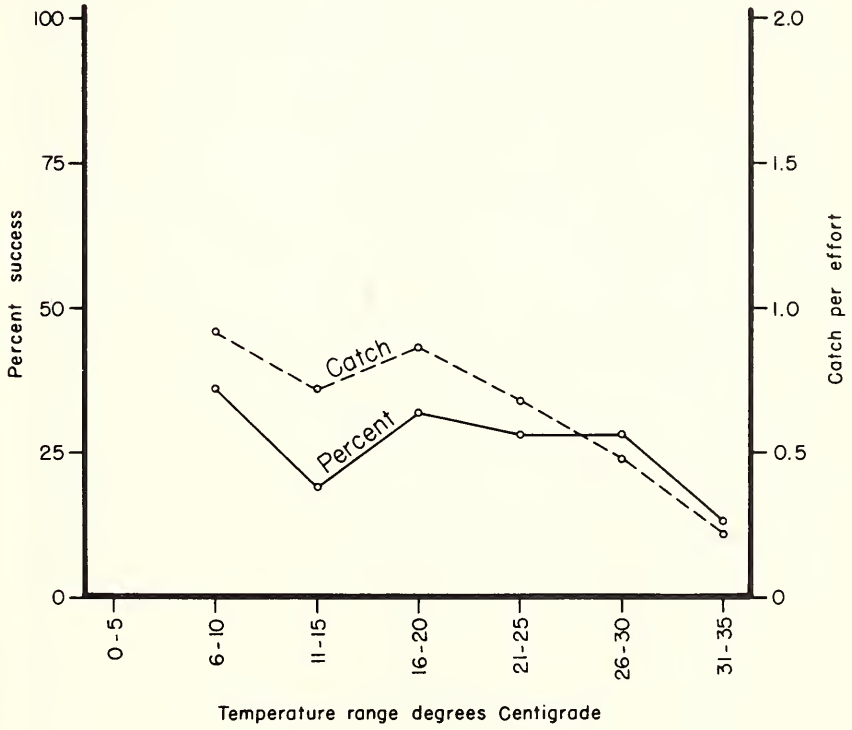


Figure 34. Trammel net catch showing the relative abundance of the Red Drum at various temperature ranges which occured during the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Red Drum captured}}{\text{Total number of sets}}$$



A monthly analysis of catch versus water temperature showed lowest yields of catch occurred during the summer months when water temperature reached high extremes (Fig. 35). During periods of too warm water, the red drum, like the spotted seatrout, remained in deeper bayou waters during the hotter parts of the day and ventured into the lagoon areas during cooler periods of night time, early morning or during rainy and cloudy weather. During the peak catches of early spring, fall and early winter, the most productive temperatures generally ran from 16°C to 25°C. Successful catches that occurred in the lower part of this range or below this range, were made primarily during sunny days that were preceded by cold and cloudy weather, after which the shallow lagoon waters, containing larger surface areas than the bayou, absorbed more sunlight and began to warm at a more rapid rate attracting the red drum. During other periods of cooler weather, red drum sought refuge in the relatively deeper bayou waters, at which time fishing would have been more successful there.

Salinity and catch: A monthly plot of catch versus salinity revealed that greater catches most often occurred in waters below 10 ppt (Fig. 36). However, most red drum captured were adolescents. As the red drum matured in the Biloxi Estuary becoming adult bull reds weighing ten pounds or more, it is felt that they gradually acquired an affinity for waters of higher salinities resulting in a migration toward and into the Gulf of Mexico. It is in the surf of the Gulf, in its deep passes and around the many oil rigs there, that very large reds are sought after by sportfishermen.

Figure 35. Trammel net catch showing the relative abundance of the Red Drum at various temperature ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Red Drum captured}}{\text{Total number of sets}}$$

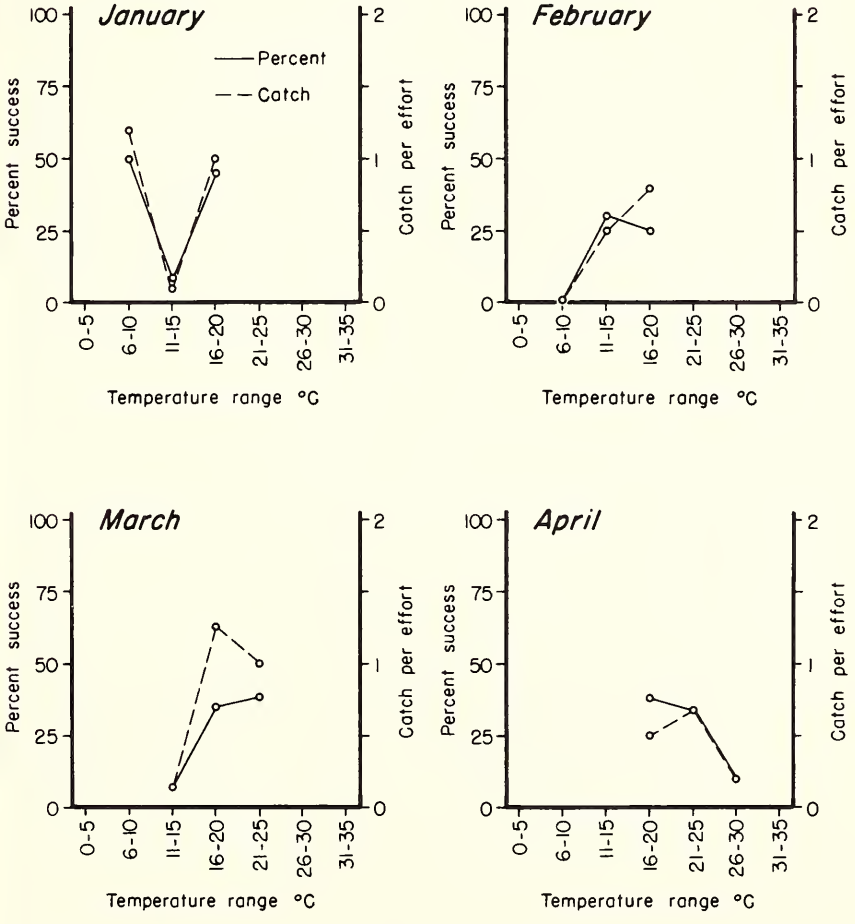


Figure 35. Red Drum, continued.

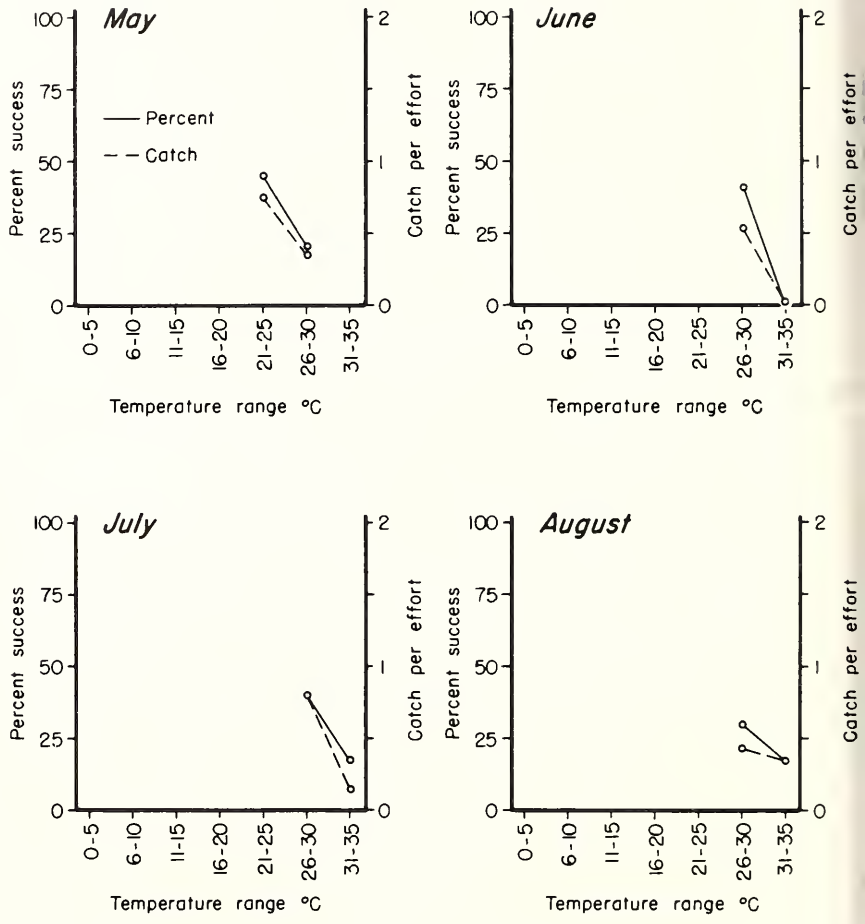


Figure 35. Red Drum, continued.

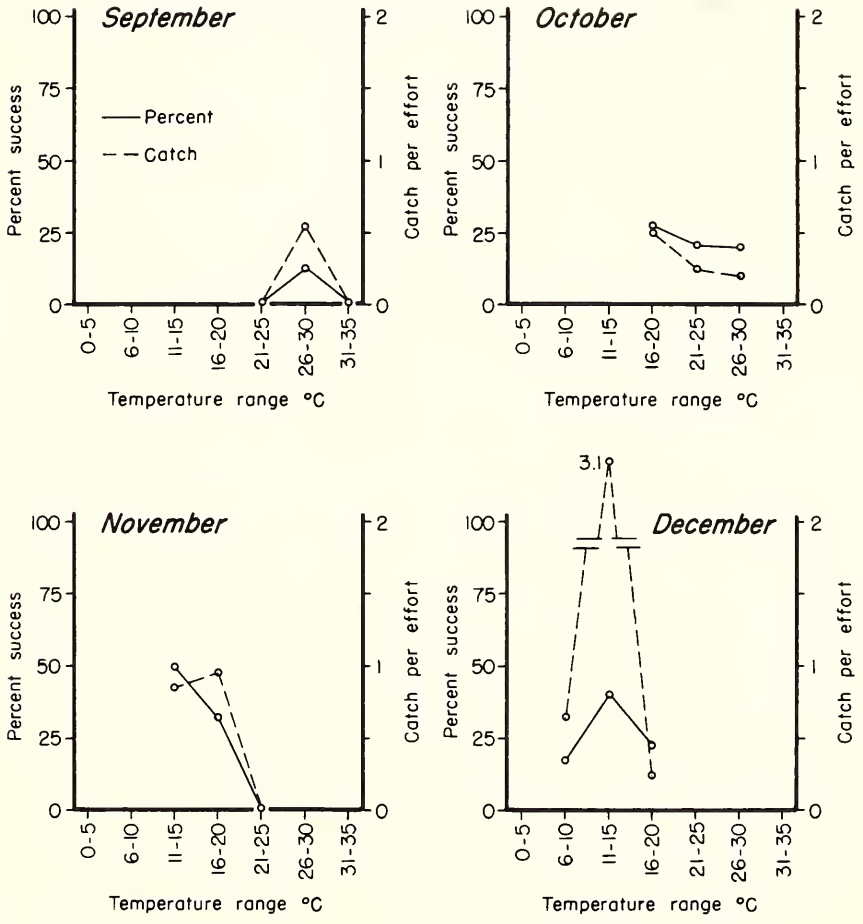


Figure 36. Trammel net catch showing the relative abundance of the Red Drum at various salinity ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Red Drum captured}}{\text{Total number of sets}}$$

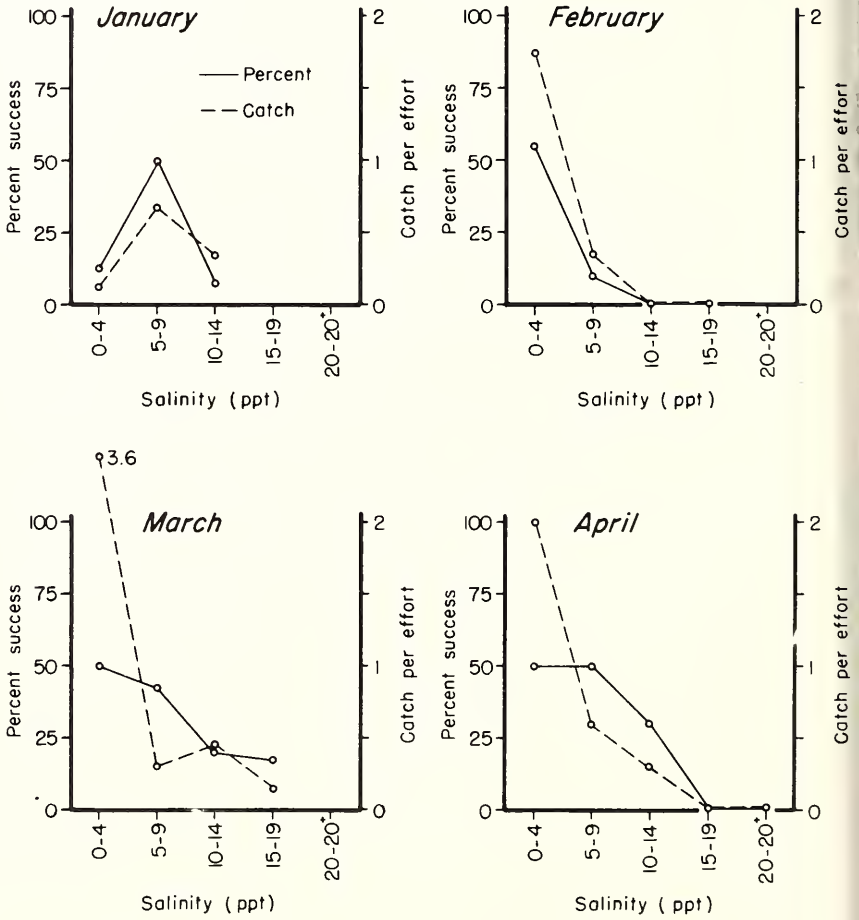


Figure 36. Red Drum, continued.

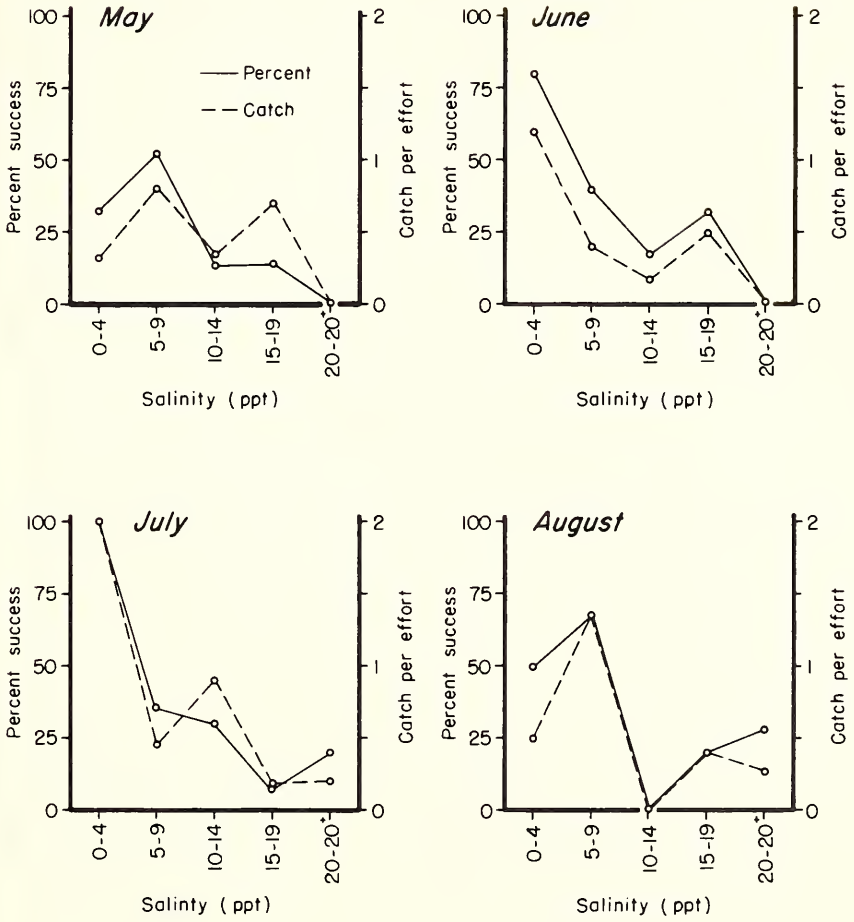
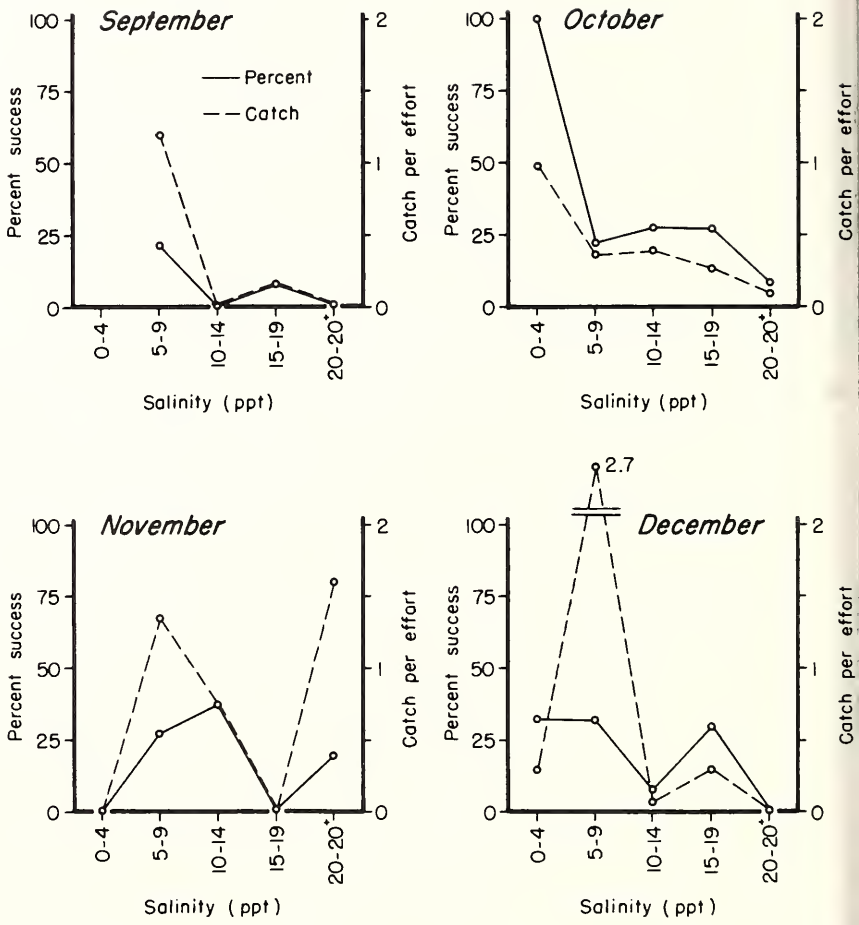


Figure 36. Red Drum, continued.



Tidal condition and catch: A monthly plot of catch versus tidal condition showed no set pattern of success. Successful catches often occurred during different tidal conditions in the same month or catches would contrast themselves from one similar month to another when sampled under the same water level (Fig. 37).

Stomach analyses: One hundred forty-seven stomachs were examined; 115 contained food organisms; 26 were empty. Crustaceans occurred in most stomachs, however, bony fin-fishes did occur in a small number of stomachs (Table 8).

The favorite crustacean and most important forage organism of the red drum is the blue crab, *Callinectes sapidus*. The *Penaeus* shrimp was second to the blue crab.

Identified fin-fishes found in the red drum's stomach is shown in Table 8. It is felt that the vegetation examined was eaten indirectly and not purposely.

Gonadal analyses: Since the majority of red drum examined were in the adolescent condition, too few adults were checked to present valid periods of spawning.

Spot, *Leiostomus xanthurus*

Seasonal relative abundance: The adult spot reached its highest peak in numbers during the month of April and remained abundant until fall when its population began to decrease finally reaching zero during the month of January (Fig. 38). Although the spot is a very numerous and tasty sciaenid, it is of little interest to the sportfishermen since it seldom bites on hook and line and must be captured using other methods such as trammel nets and other type nets.

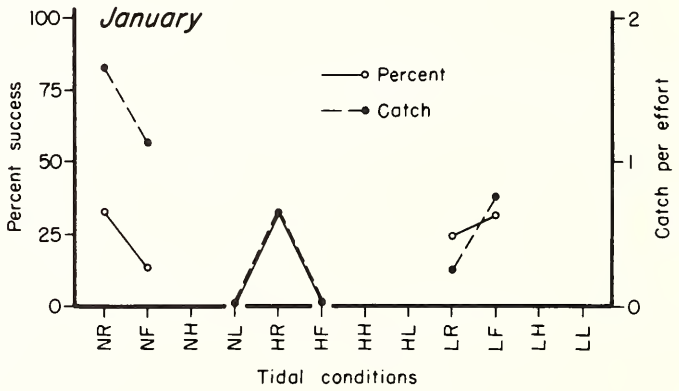
Figure 37. Trammel net catch showing the relative abundance of the Red Drum at various tidal conditions by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Red Drum captured}}{\text{Total number of sets}}$$

LEGEND–

NR = Normal, rising	HR = Prevailing high, rising	LR = Prevailing low, rising
NF = " , falling	HF = " " , falling	LF = " " , falling
NH = " , high ebb	HH = " " , high ebb	LH = " " , high ebb
NL = " , low ebb	HL = " " , low ebb	LL = " " , low ebb



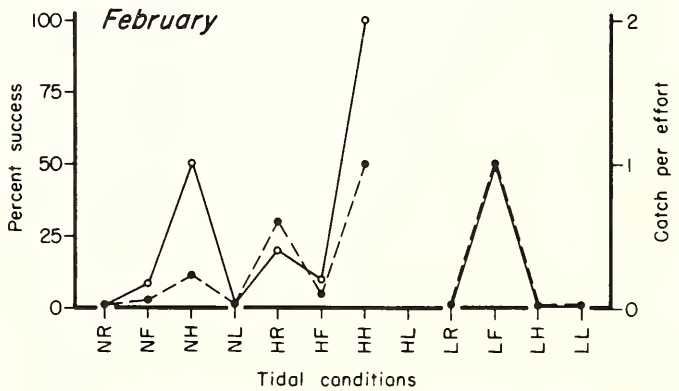


Figure 37. Red Drum, continued.

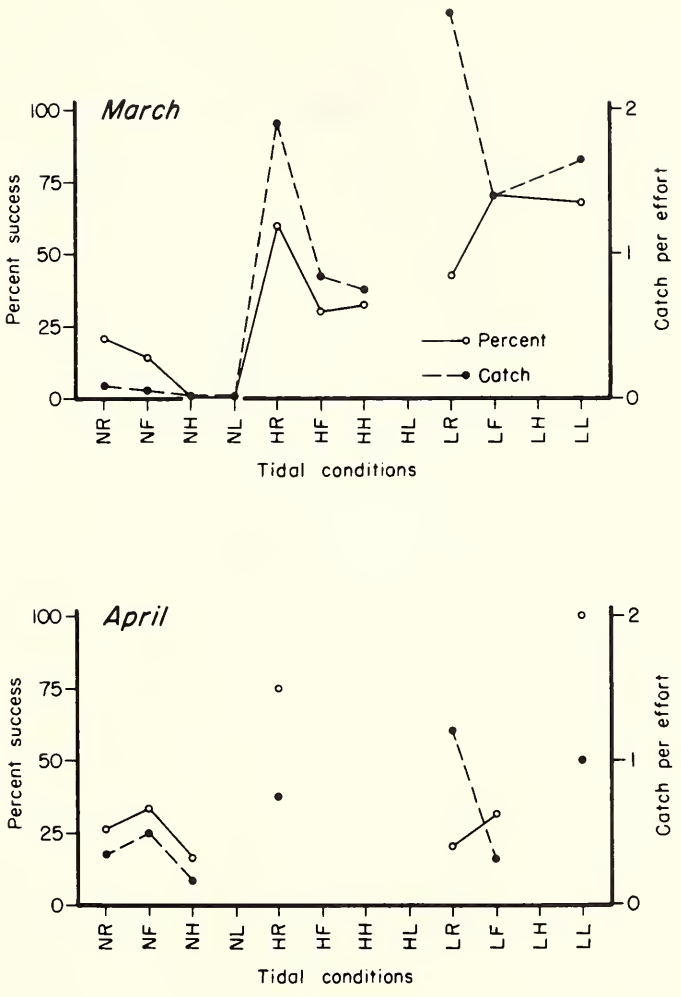


Figure 37. Red Drum, continued.

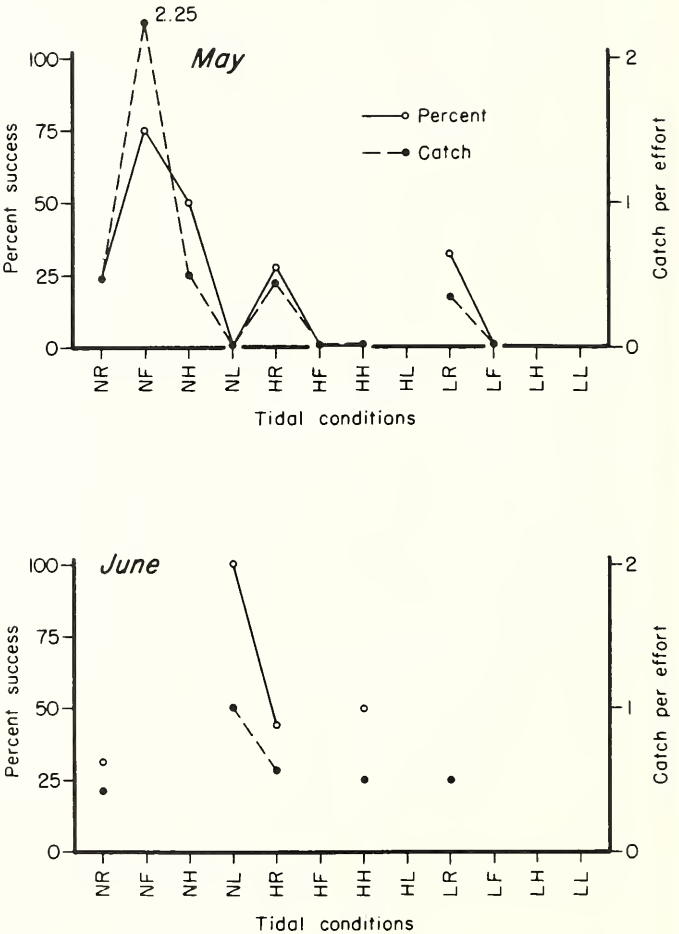


Figure 37. Red Drum, continued.

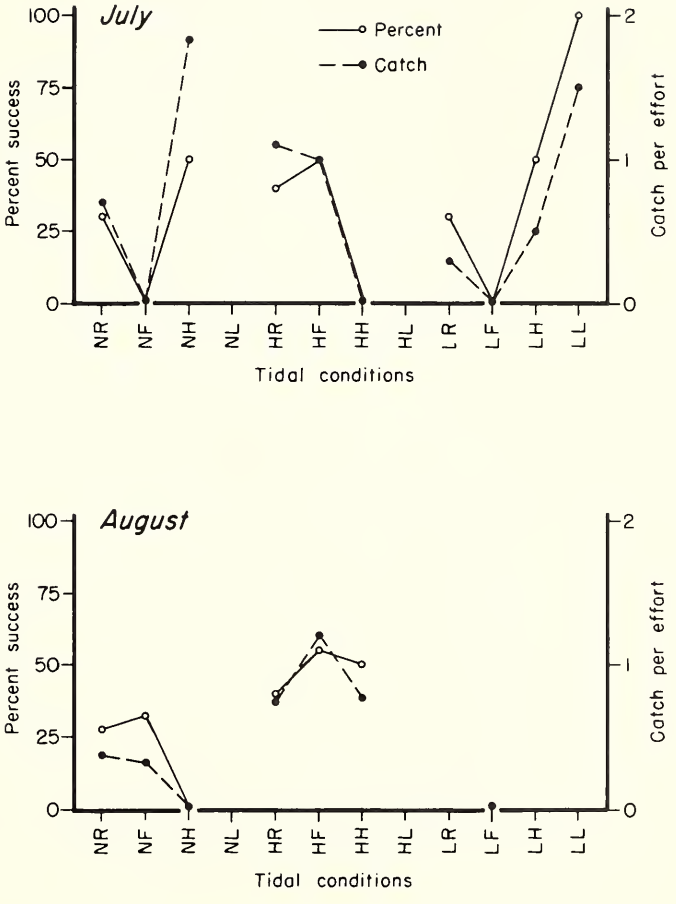


Figure 37. Red Drum, continued.

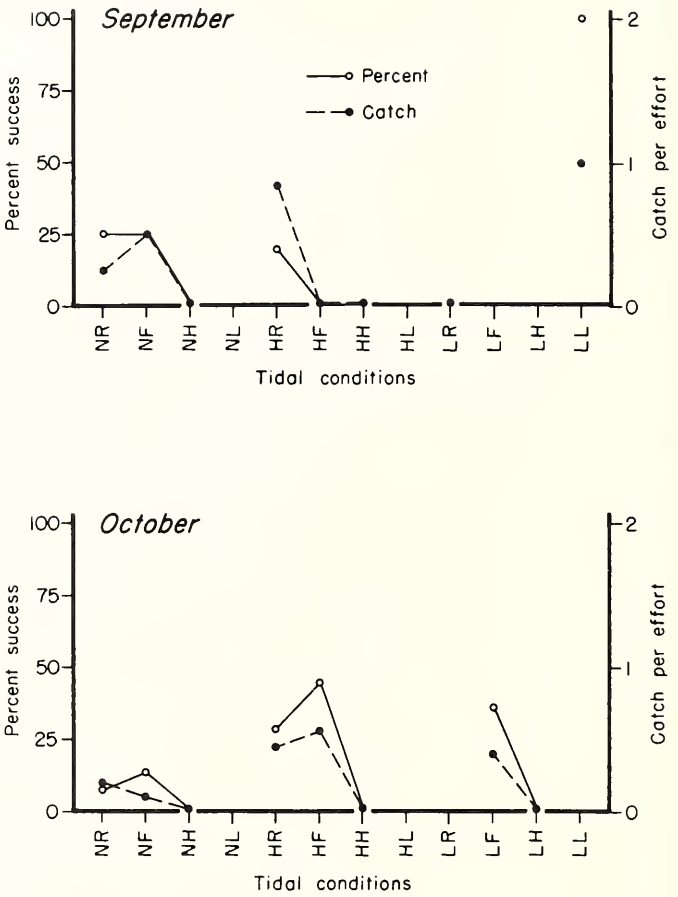


Figure 37. Red Drum, continued.

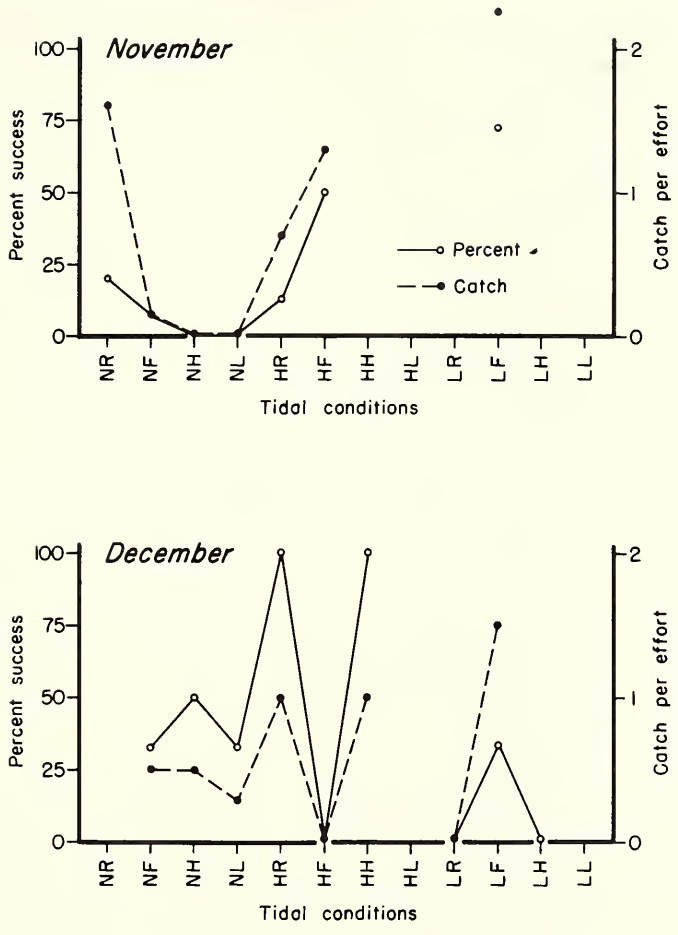


Table 8

Red drum stomach contents with number and percent occurrence of stomachs containing them 141 stomachs examined; 110 contained food; 31 empty

Stomach contents	*No. Stomachs*	*% Occurrence*
Polychaeta	*1*	*0.9*
Errantia		
Clam worm	1	0.9
Crustacea		
Isopoda	8	7.3
Cymothoidae		
Isopod		
Amphipoda		
Gammaridae		
Amphipod	7	6.4
Decapoda		
Penaeidae		
Penaeid shrimp	17	15.3
Palaemonidae		
Grass shrimp	8	7.3
Portunidae		
Blue crab	43	39.0
Unidentifiable		
(Appeared to be partially digested blue crabs)	32	29.1
Osteichthyes		
Clupeiformes		
Clupeidae		
Skipjack herring	1	0.9
Engraulidae		
Bay anchovy	1	0.9
Anguilliformes		
Ophichthidae		
Snake eel sp.	3	2.7
Beloniformes		
Belonidae		
Atlantic needlefish	1	0.9
Cyprinodontiformes		
Cyprinodontidae		
Gulf killifish	2	1.8

Stomach contents	*No. Stomachs*	*% Occurrence*
Gadiformes		
Syngnathidae		
Pipefish sp.	1	0.9
Perciformes		
Mugilidae		
Striped mullet	1	0.9
Pleuronectiformes		
Bothidae		
Southern flounder	1	0.9
Tetraodontiformes		
Tetraodontidae		
Southern puffer	4	3.6
Unidentifiable	25	22.7
Animal Matter	*2*	*1.8*
(Unidentifiable)		
Vegetation		
(Unidentifiable)	*14*	*12.7*

Sheepshead, *Archosargus probatocephalus*

Although not a member of the Scaenid family, the sheepshead was another favorite and populous game fish in the study area.

Seasonal relative abundance and size distribution: Only during September was catch of sheepshead relatively low as compared to other months. Peaks in catch occurred during winter, spring, summer and fall (Fig. 39).

Sheepshead weighing about .5 pounds to 5.5 pounds composed approximately 96 percent of the population sampled (Fig. 40), and were in the five inch to twenty-two inch class category (Fig. 41). The largest sheepshead collected weighed approximately 8½ pounds.

Movement data from tagging returns is shown in Table 4.

Temperature and catch: A yearly plot of temperature versus catch showed little variation in catch when comparing the various temperature ranges sampled (Fig. 42). However, a monthly analysis of temperature versus catch revealed that catch tended to decline when waters reached 35° C or when waters were below 11° C (Fig. 43). Peak catches occurred during most other ranges.

Figure 38. Trammel net catch showing relative monthly abundance of the Spot combining catch from all stations for the period 1960 - 1968.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} \quad \frac{\text{Total number Spot captured}}{\text{Total number of sets}}$$

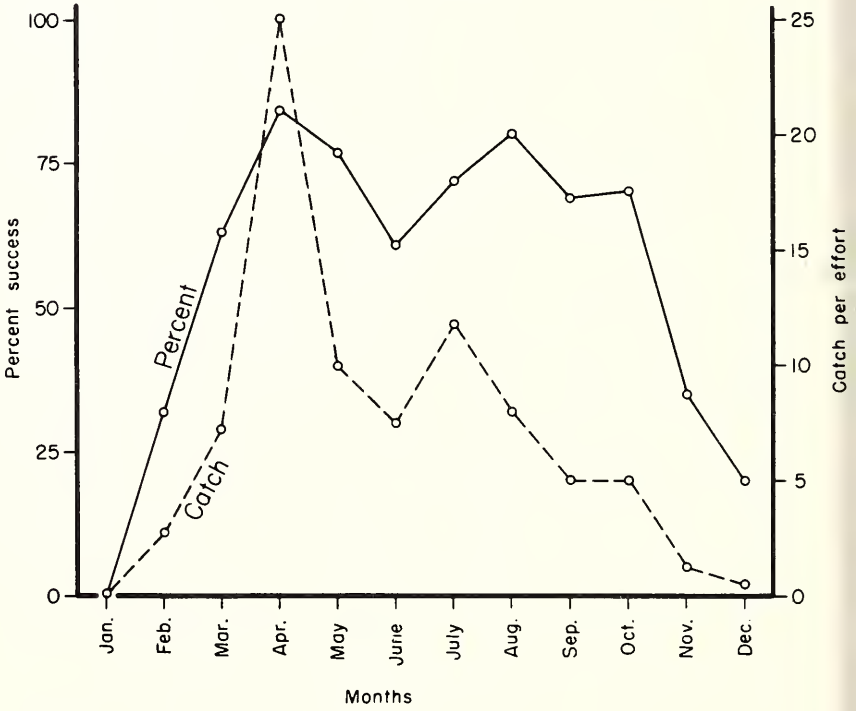


Figure 39. Trammel net catch showing relative monthly abundance of the Sheepshead combining catch from all stations for the period 1960-68.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Sheepshead captured}}{\text{Total number of sets}}$$

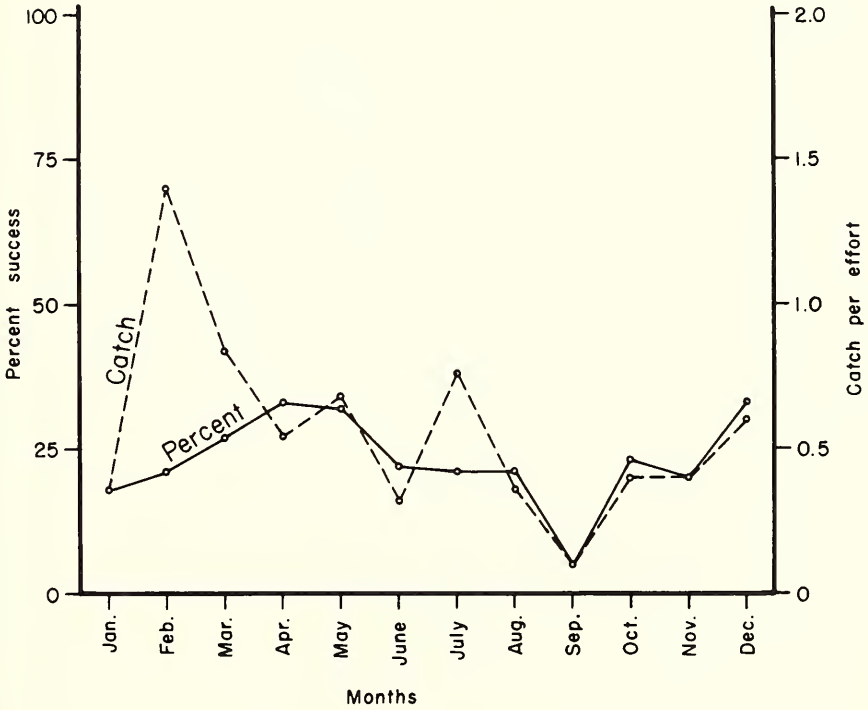


Figure 40. Percent occurrence of various weights of the Sheepshead captured during the period 1960 - 1968, combining all stations.

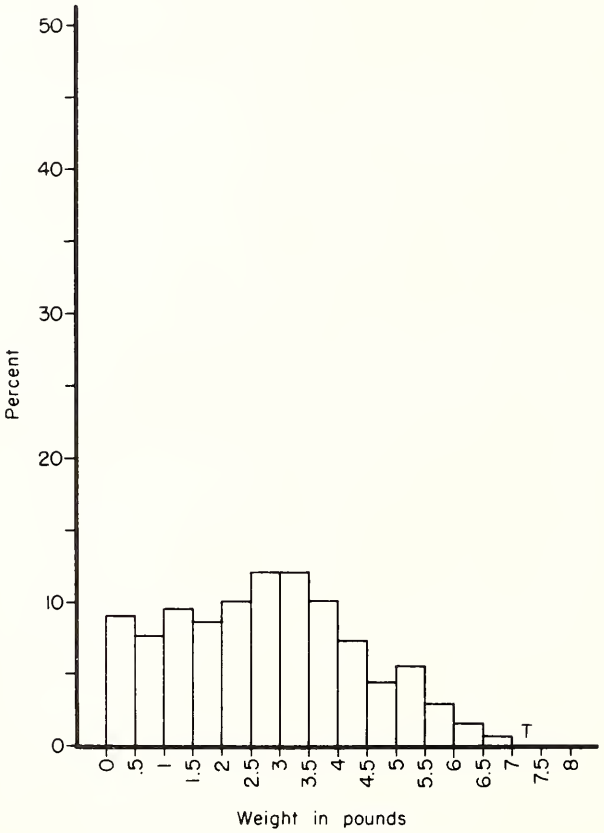


Figure 41. Percent occurrence of various lengths of the Sheepshead captured during the period 1960 - 1968, combining all stations.

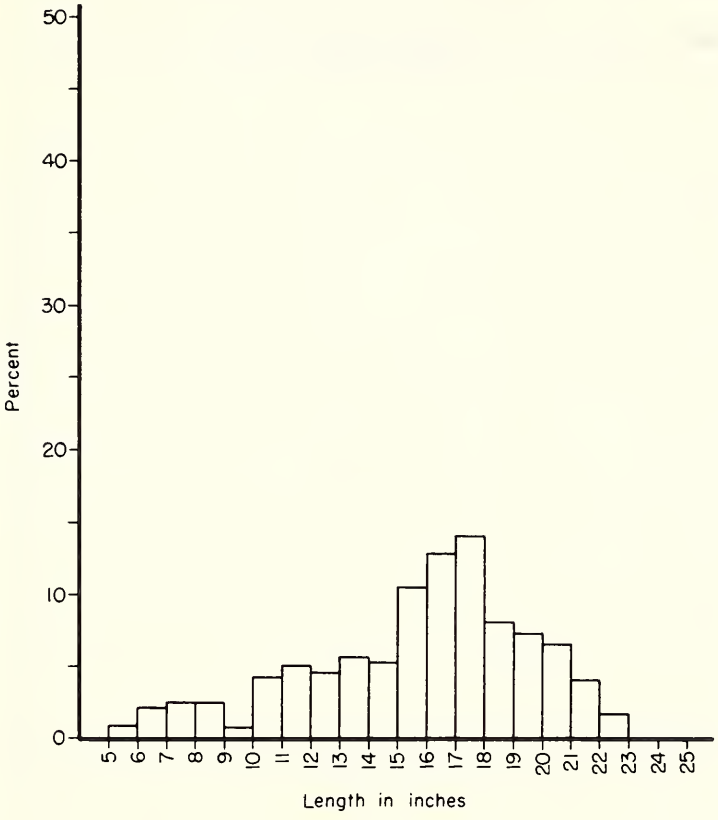


Figure 42. Trammel net catch showing the relative abundance of the Sheepshead at various temperature ranges which occured during the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Sheepshead captured}}{\text{Total number of sets}}$$

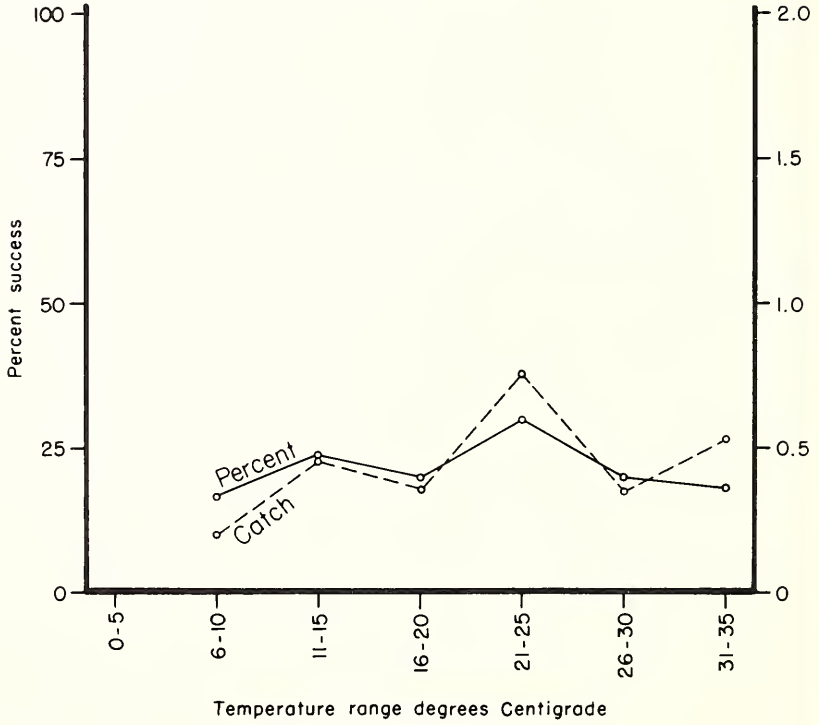


Figure 43. Trammel net catch showing the relative abundance of the Sheepshead at various temperature ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Sheepshead captured}}{\text{Total number of sets}}$$

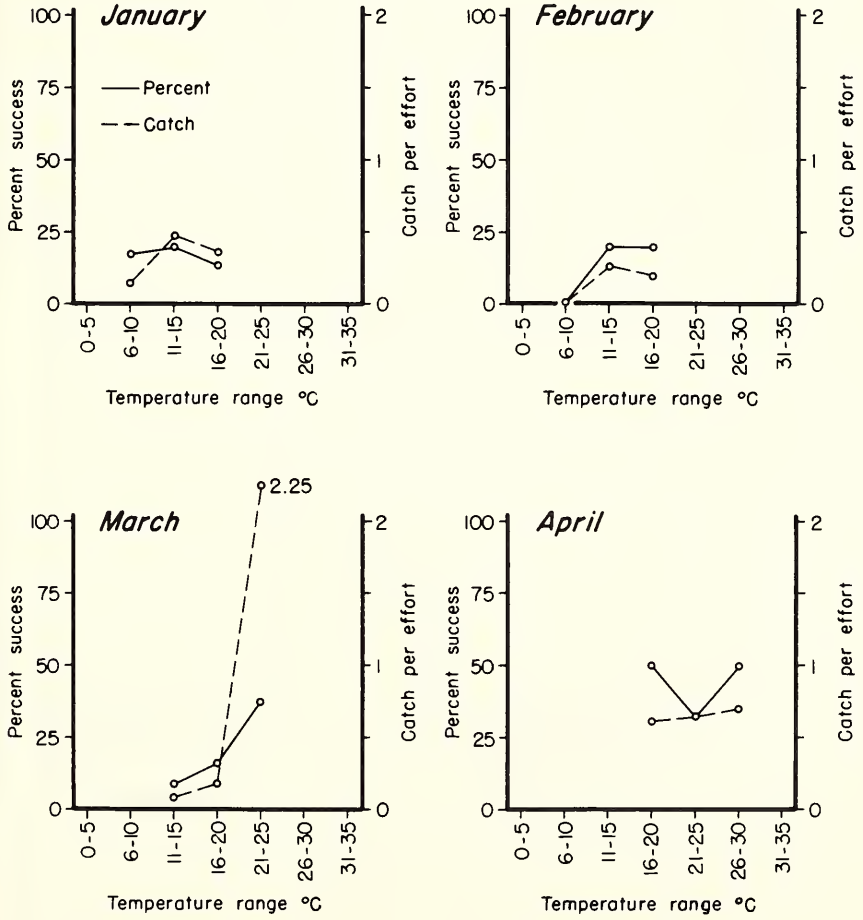


Figure 43. Sheepshead, continued.

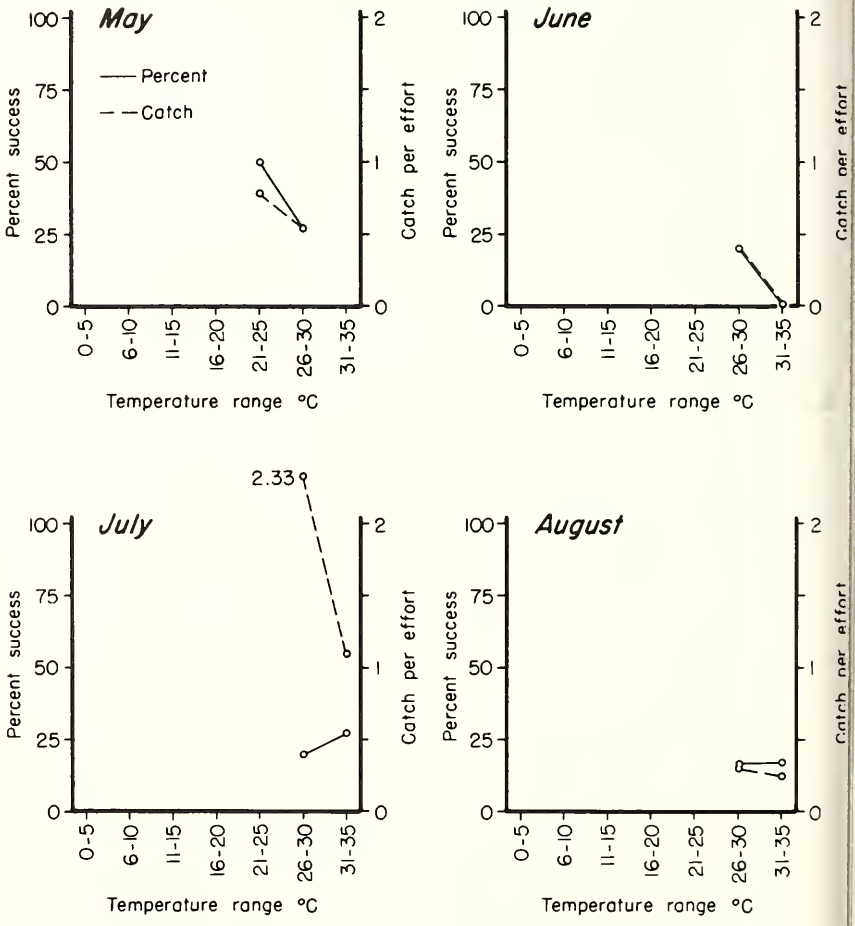
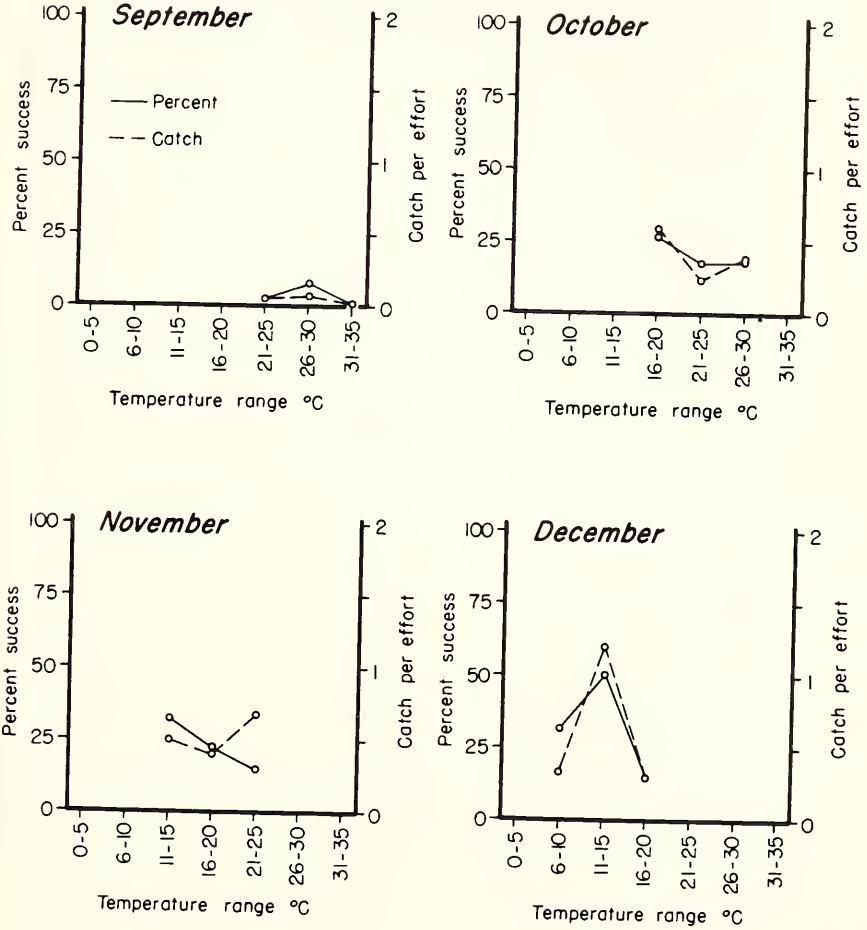


Figure 43. Sheepshead, continued.



Salinity and catch: A monthly plot of catch versus salinity revealed that during some months peak catches occurred at the low and high extremes of salinities sampled (Fig. 44). During other months little variation in catch occurred when comparing the various salinities. Because of this, it is felt that the normal changes of salinity in the study area does not affect as such the movements of sheepshead to and from the lagoon and lake areas.

Tidal condition and catch: A monthly plot of catch versus tidal condition showed that the most successful catches often occurred during the prevailing high-falling or prevailing high-rising tidal conditions (Fig. 45). This was especially apparent during the months of January, February, March, May, June, September and December. Except for the months of April, May, July and December, catch was generally low when sampled during prevailing low tidal conditions.

Stomach analysis: Fifty-two stomachs were examined; 43 contained food organisms; 9 were empty. Pelycypods occurred in 14 percent of the stomachs that had food organisms; crustaceans occurred in 16.3 percent; partially digested vegetation of the green algae type occurred in 69.8 percent (Table 9).

Pelycypods consisted of commercial oysters and Rangia clams. The more important crustaceans examined were amphipods, blue crabs, *Callicnectes sapidus* and *Penaeus* shrimp.

Like in many of the other fishes examined, it is not certain whether the plant material was ingested purposely or indirectly.

Gonadal analysis: A major spawning period was observed during February through May and a minor period during October into the first part of December (Fig. 46).

Figure 44. Trammel net catch showing the relative abundance of the Sheepshead at various salinity ranges by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch / effort} = \frac{\text{Total number Sheepshead captured}}{\text{Total number of sets}}$$

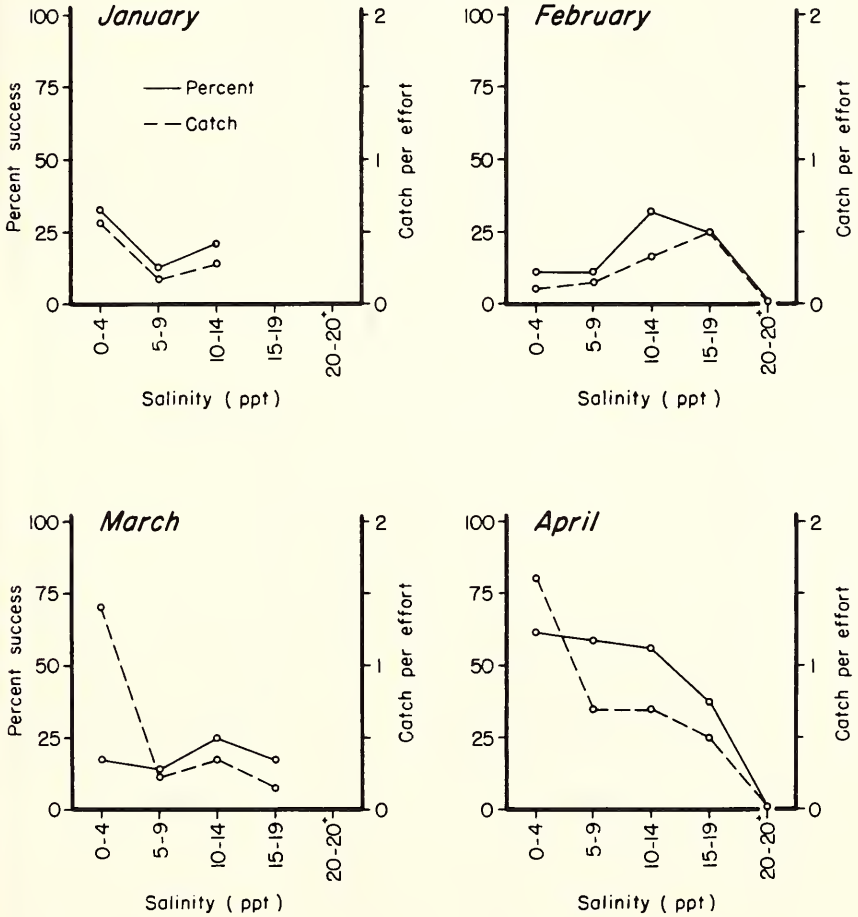


Figure 44. Sheepshead, continued.

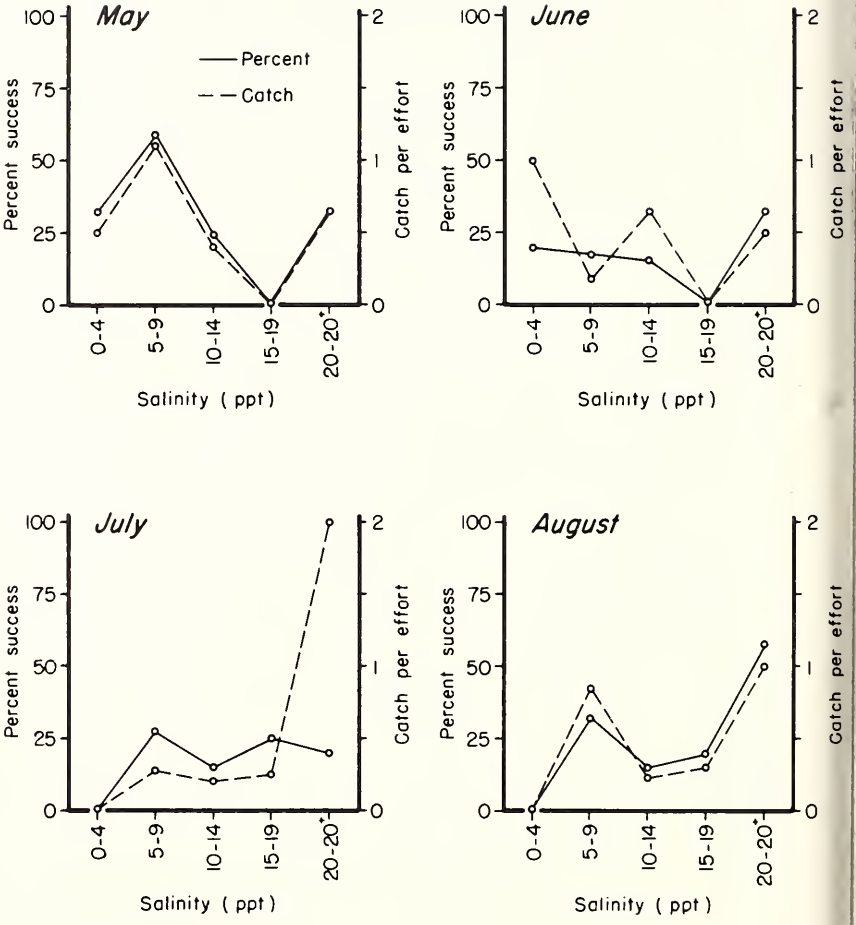


Figure 44. Sheepshead, continued.

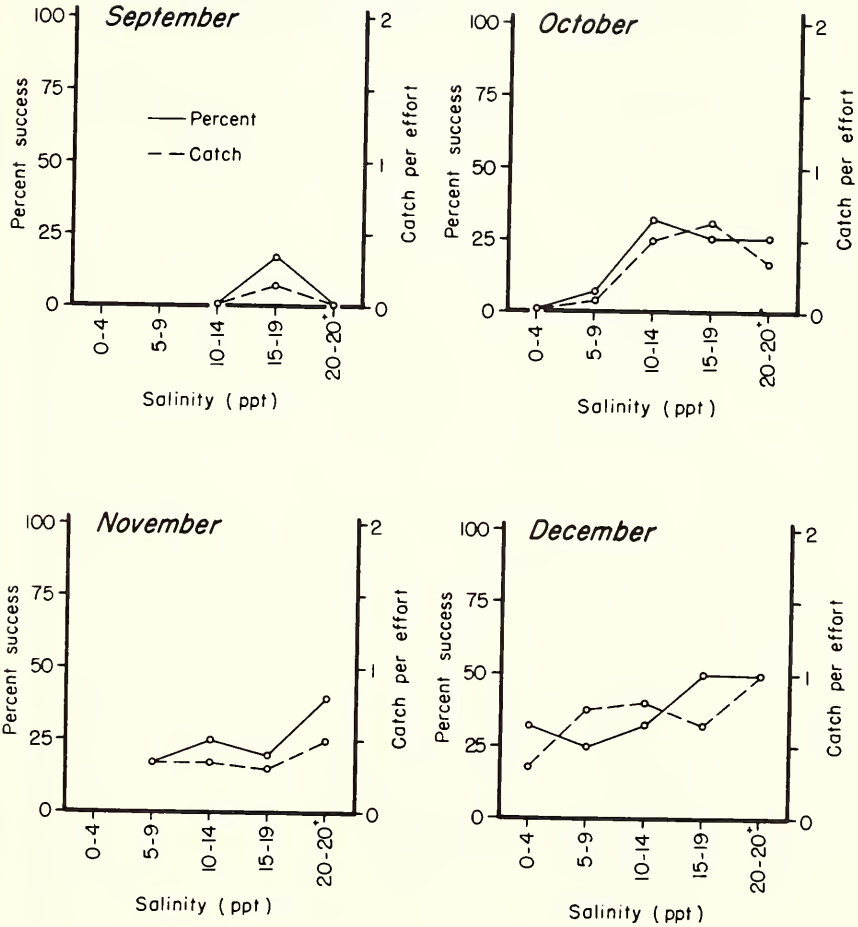


Figure 45. Trammel net catch showing the relative abundance of the Sheepshead at various tidal conditions by month for the period 1960-68 combining all stations.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Sheepshead captured}}{\text{Total number of sets}}$$

LEGEND–

NR = Normol, rising	HR = Prevailing high, rising	LR = Prevailing low, rising
NF = " , falling	HF = " " , falling	LF = " " , falling
NH = " , high ebb	HH = " " , high ebb	LH = " " , high ebb
NL = " , low ebb	HL = " " , low ebb	LL = " " , low ebb

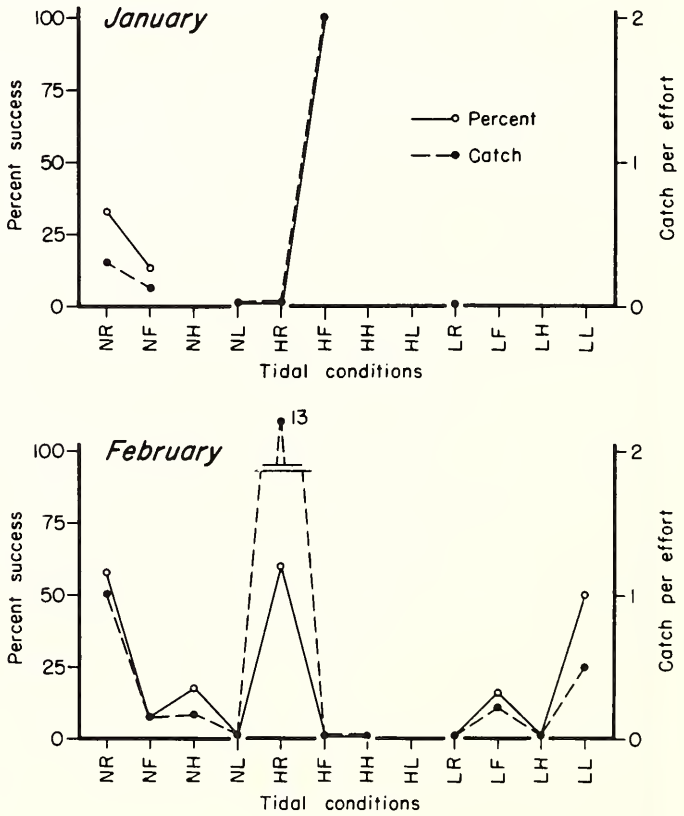


Figure 45. Sheepshead, continued.

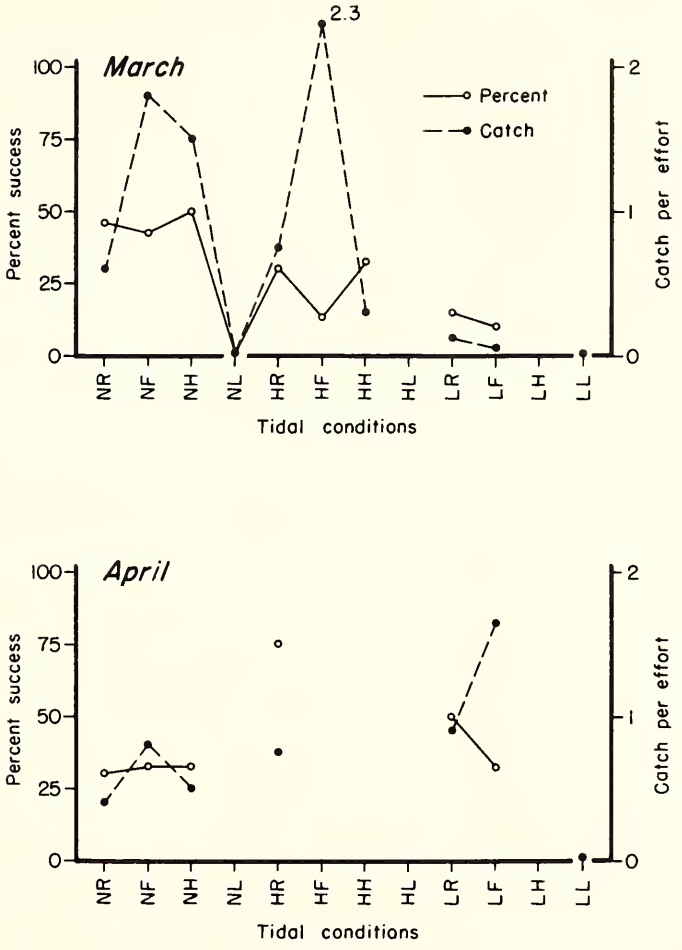


Figure 45. Sheepshead, continued.

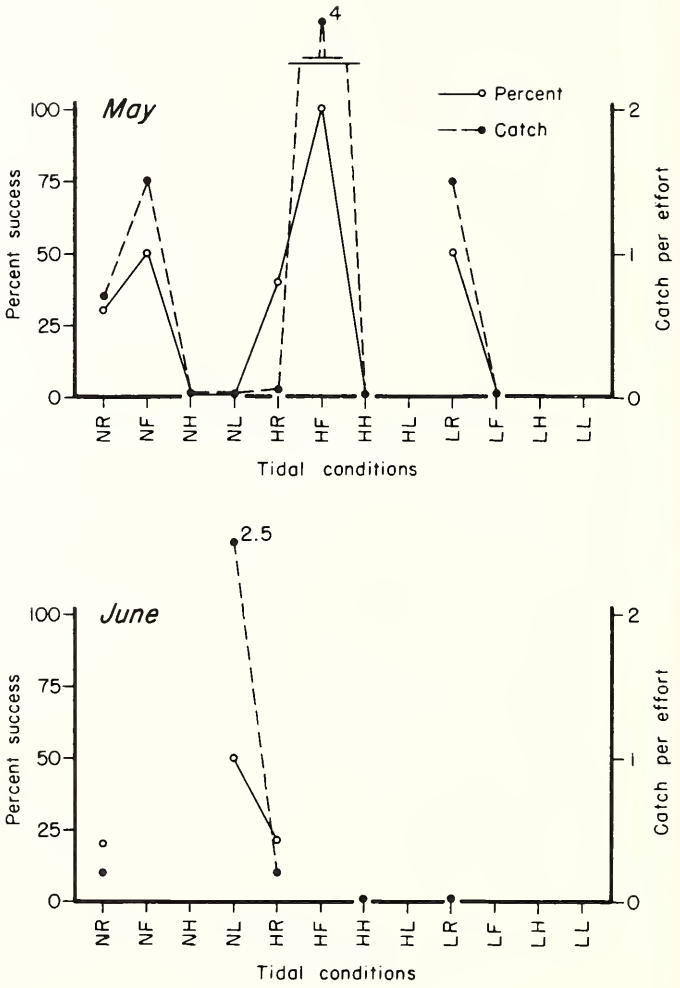


Figure 45. Sheepshead, continued.

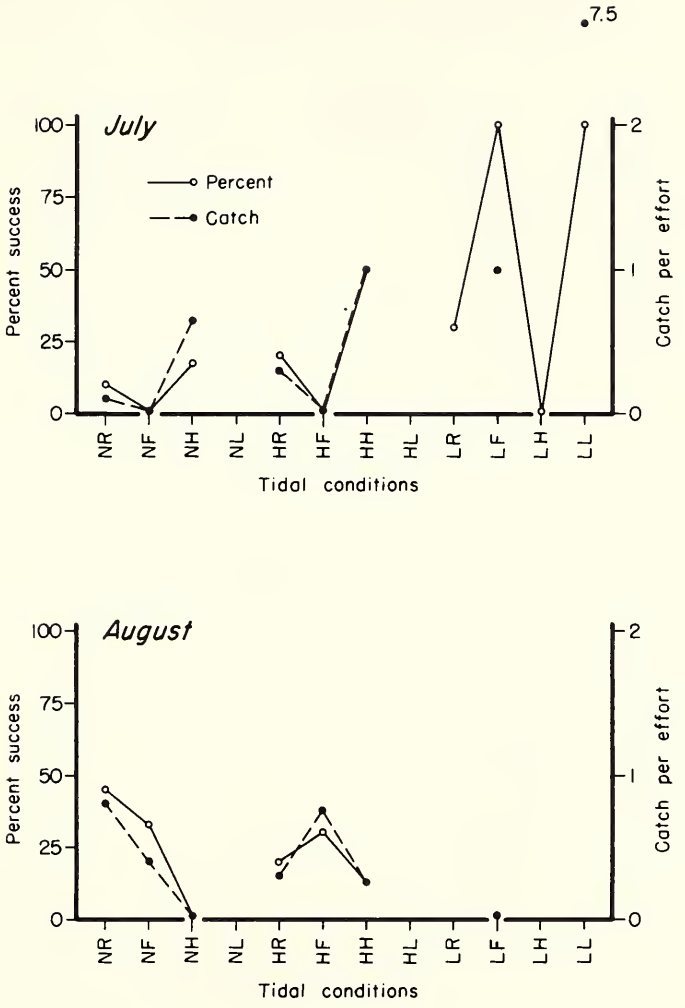


Figure 45. Sheepshead, continued.

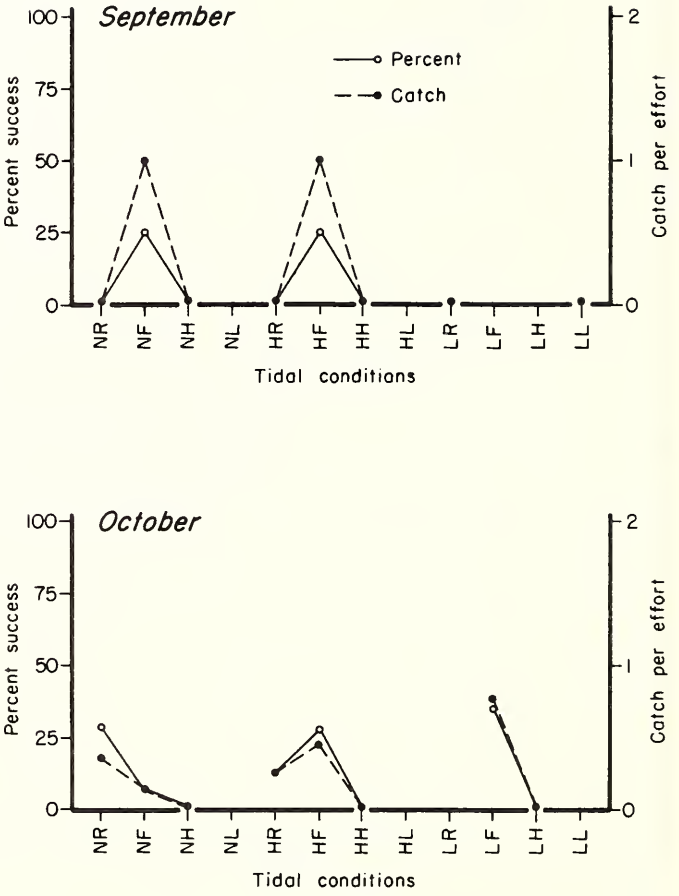


Figure 45. Sheepshead, continued.

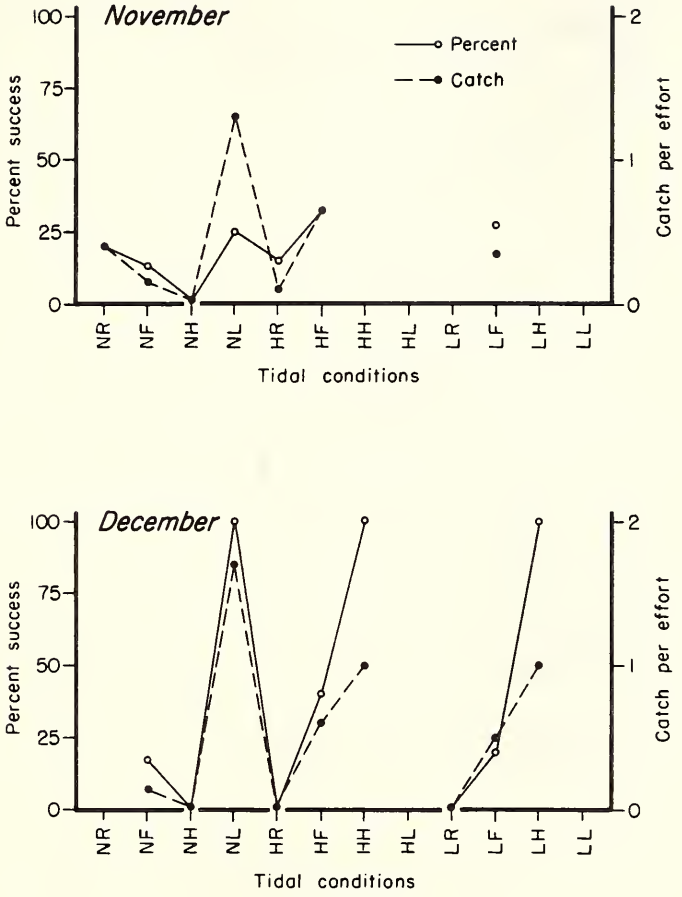
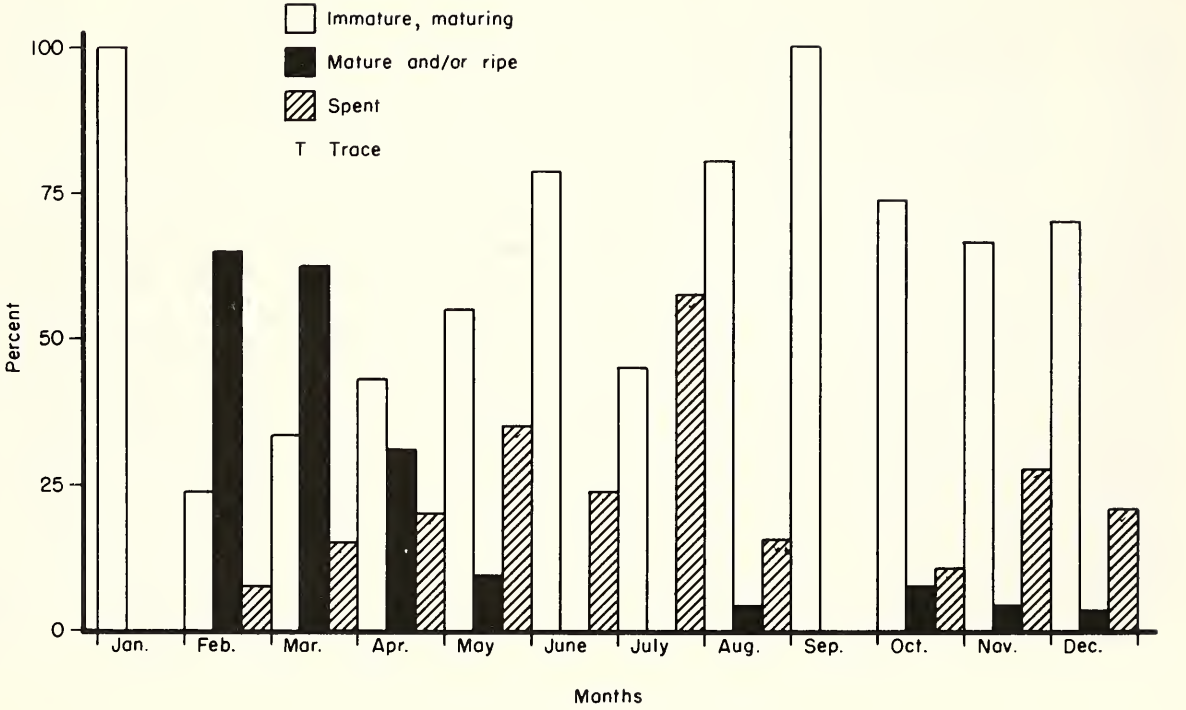


Table 9

Sheepshead stomach contents with number and percents occurrence of stomachs containing them. 52 stomachs examined; 43 contained food; 9 empty

Stomach Contents	*No. Stomachs*	*% Occurrence*
Pelycypoda	*6*	*14.0*
Oyster and/or clam shells	6	14.0
Crustacea		
Amphipoda	*15*	*32.5*
Gammaridae		
Amphipod	4	9.3
Decapoda		
Penaeidae		
Penaeid shrimp	3	7.0
Portunidae		
Blue Crab	3	7.0
Unidentifiable (Partially digested crab species)	3	7.0
Insecta (unidentifiable partially digested insect species)	2	4.7
Animal Matter (Unidentifiable)	*7*	*16.3*
Vegetation (Partially digested)	*30*	*69.8*

Figure 46. Percent occurrence of Sheepshead's gonadal condition by month for period 1960 - 68, combining all stations.



Spawning was observed during temperature range 16° C to 30° C with the greatest portion occurring during the 21° C to 25° C range (Fig. 47).

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A species list of all organisms captured with the trammel net, trawl, bobbinet and cast net is shown in Table 3.

Water Chemistries

pH: An average pH of approximately 8 was predominate at all stations and remained very stable throughout the entire study period (Fig. 51). Note also in Figure 51 the very narrow range of pH that occurred above and below the average pH for each month.

Alkalinity (bicarbonate and carbonate): The bicarbonate range was usually not too far spread when comparing areas, months or years (Tables 10-14). A few exceptions did occur however. A low reading of 14 ppm* was recorded at Stump Lagoon Station in September, 1965, and a high reading of 229 ppm at Lake Eloi Station in November, 1965. These two extremes occurred only once during the 8 year period.

Carbonates were nearly always zero.

CO_2: The amount of free CO_2 was similar and remained rather stable at all stations during the 8 year study period (Table 15). The lowest CO_2 recorded was 0 ppm which occurred several times at most stations and the highest was 15 ppm which occurred only once and was recorded at the Lake Eloi Station September, 1965.

* Denotes parts per million throughout this report.

Figure 45. Sheepshead, continued.

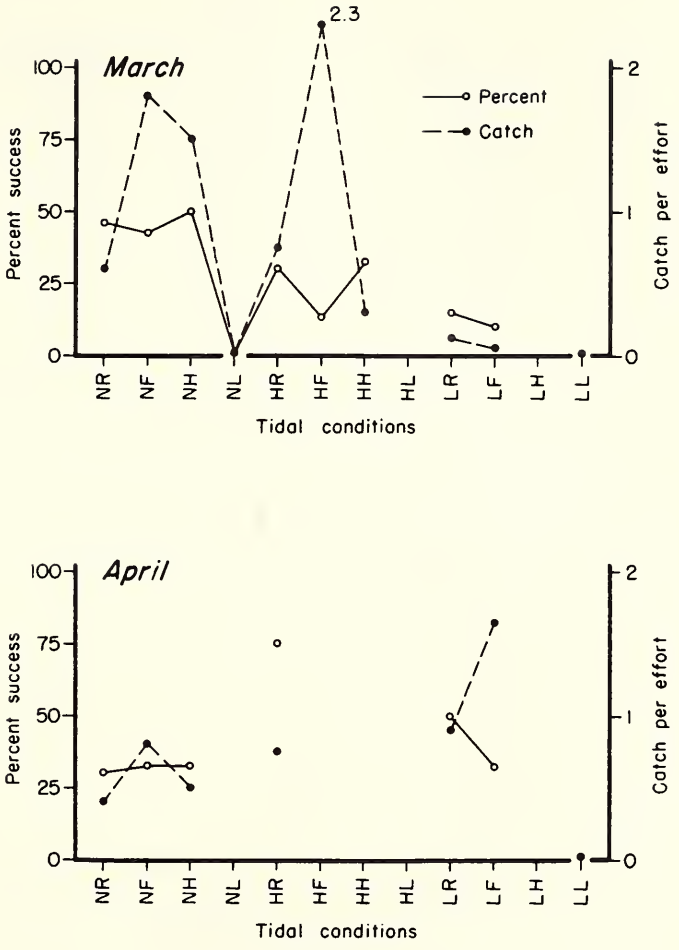

Figure 45. Sheepshead, continued.

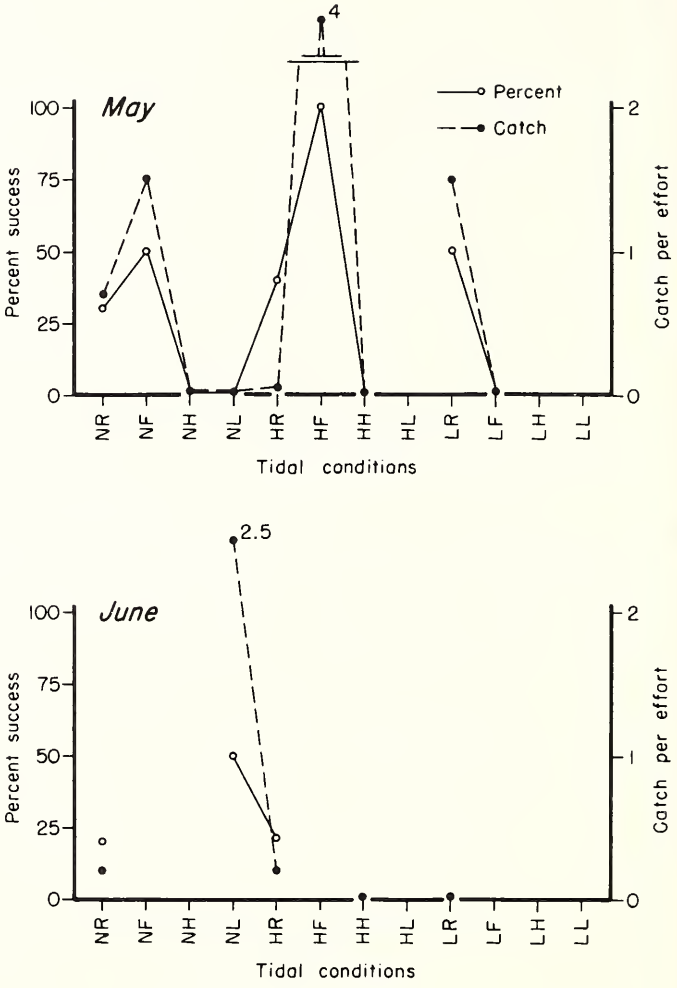

Figure 45. Sheepshead, continued.

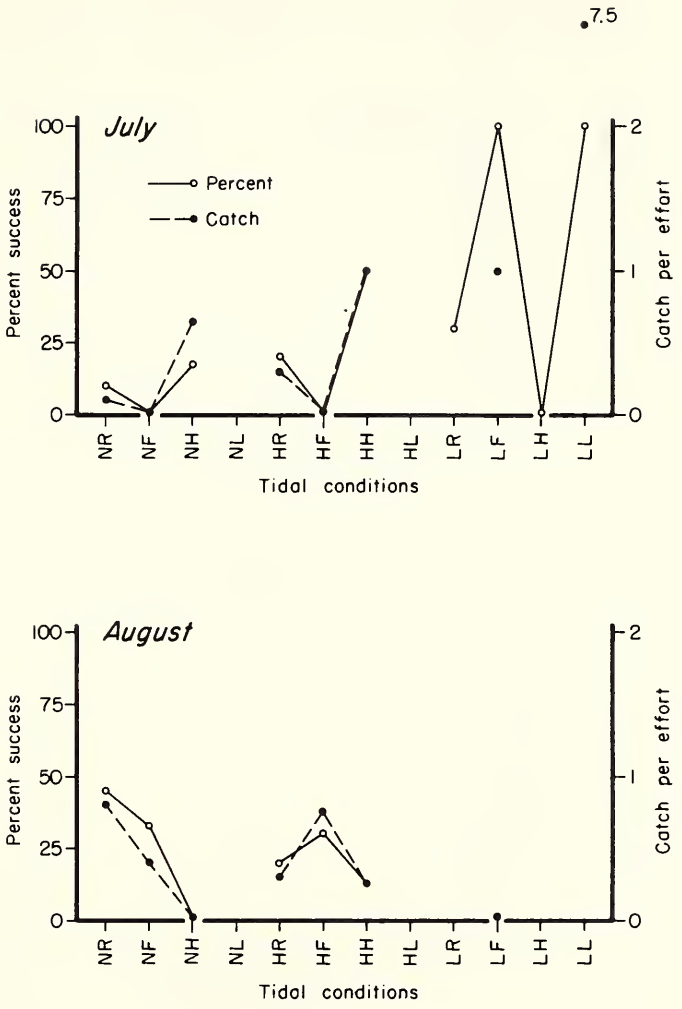

Figure 45. Sheepshead, continued.

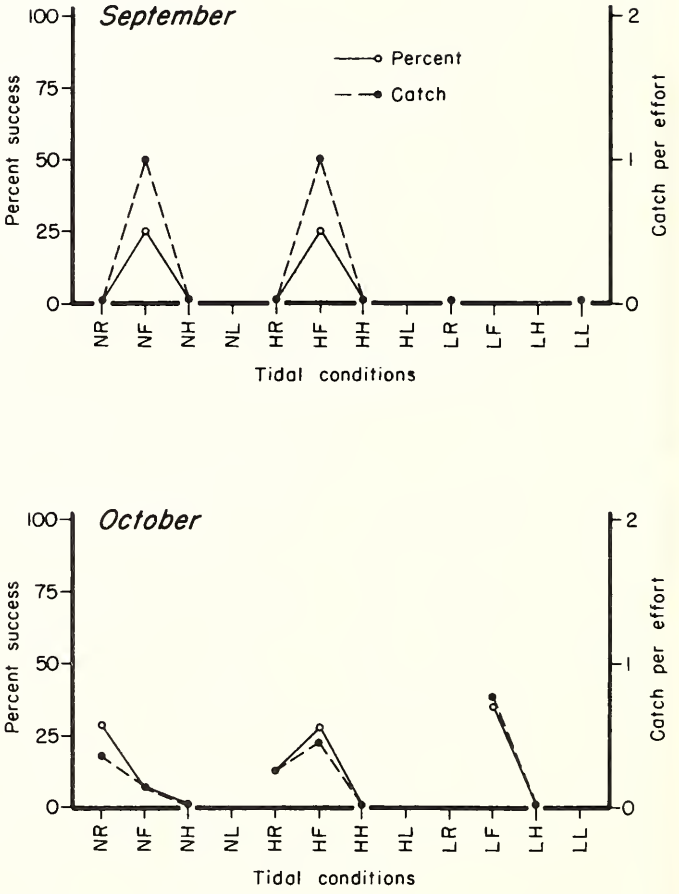

Figure 45. Sheepshead, continued.

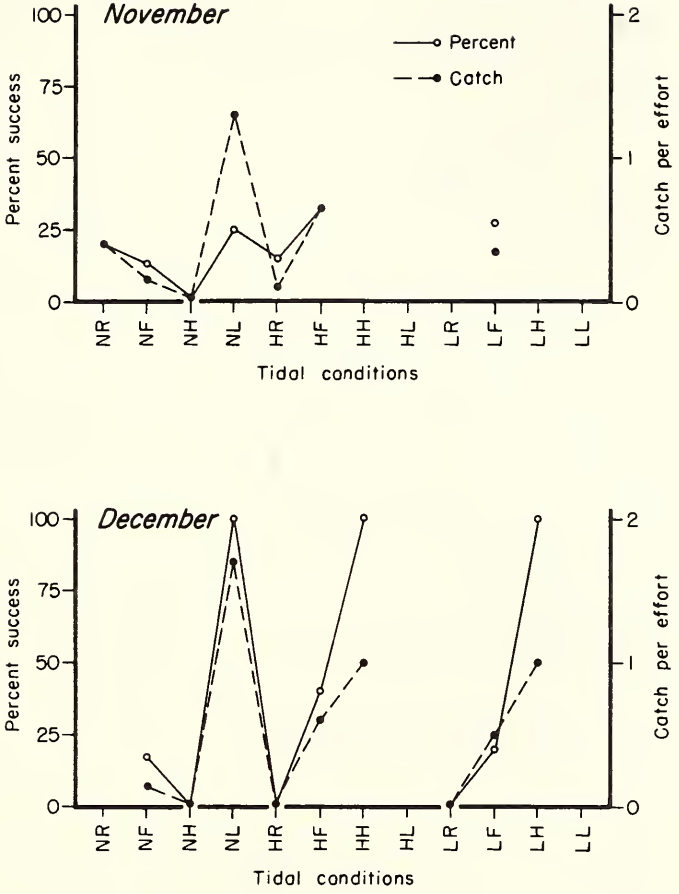

Table 9

Sheepshead stomach contents with number and percents occurrence of stomachs containing them. 52 stomachs examined; 43 contained food; 9 empty

Stomach Contents	*No. Stomachs*	*% Occurrence*
Pelycypoda	*6*	*14.0*
Oyster and/or clam shells	6	14.0
Crustacea		
Amphipoda	*15*	*32.5*
Gammaridae		
Amphipod	4	9.3
Decapoda		
Penaeidae		
Penaeid shrimp	3	7.0
Portunidae		
Blue Crab	3	7.0
Unidentifiable (Partially digested crab species)	3	7.0
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Animal Matter (Unidentifiable)	*7*	*16.3*
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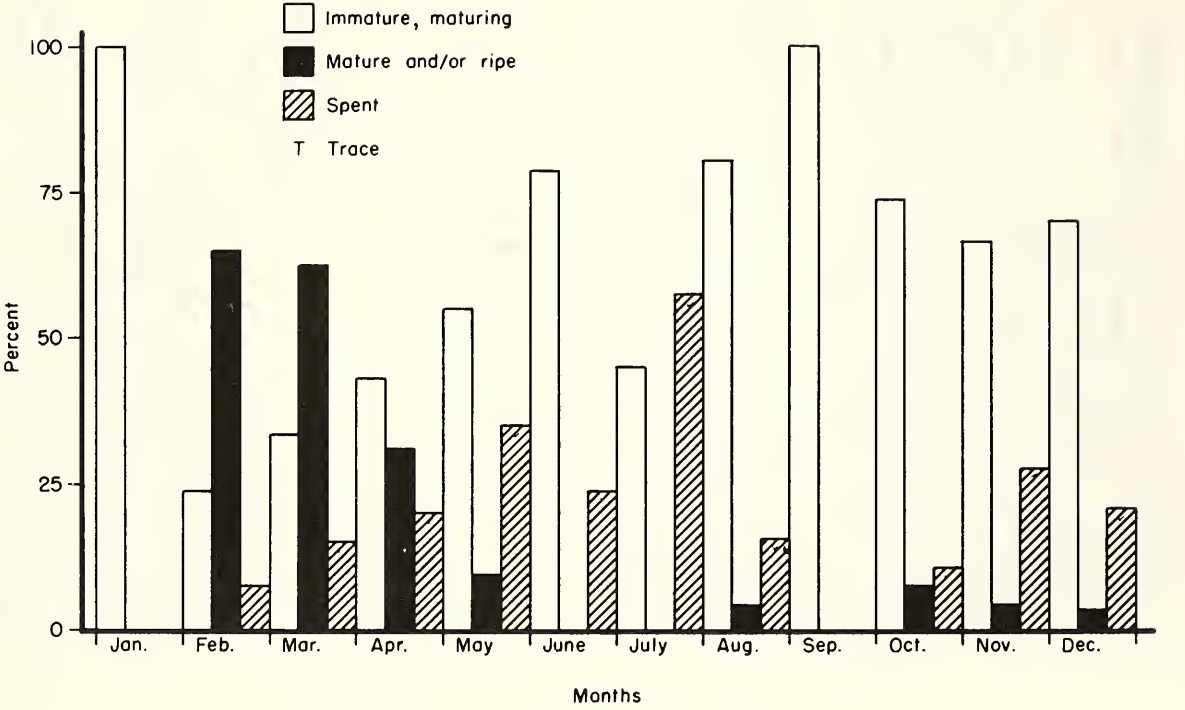

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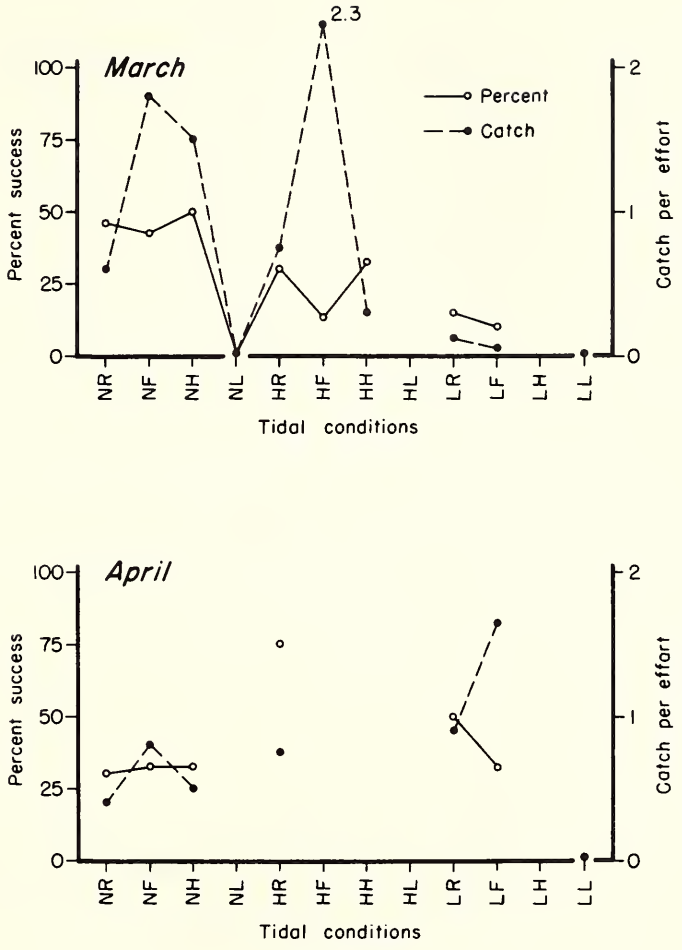

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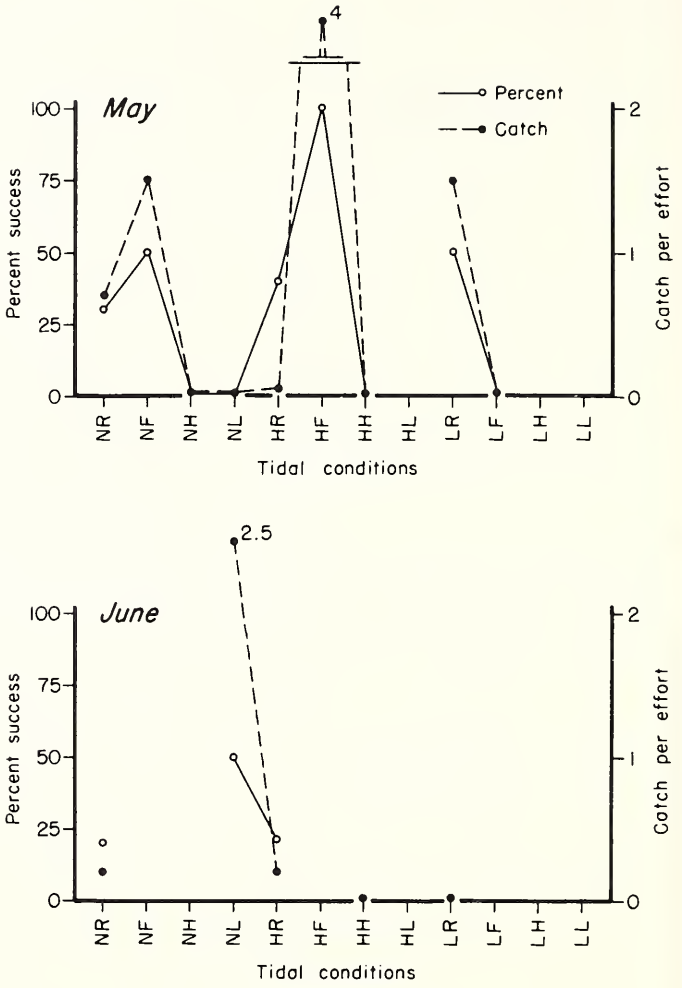


Figure 45. Sheepshead, continued.

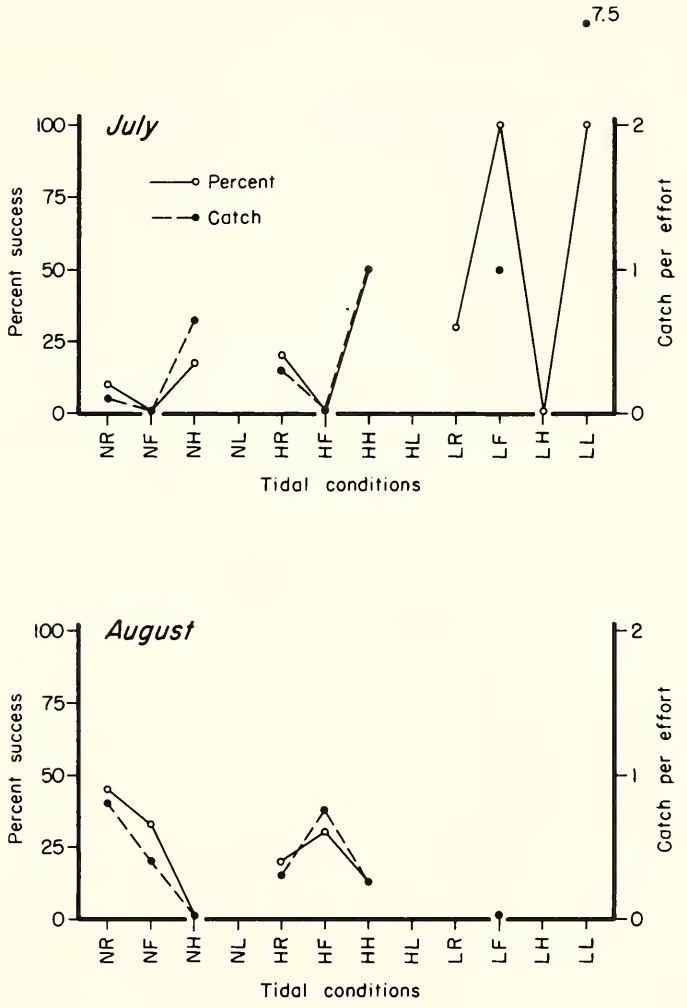


Figure 45. Sheepshead, continued.

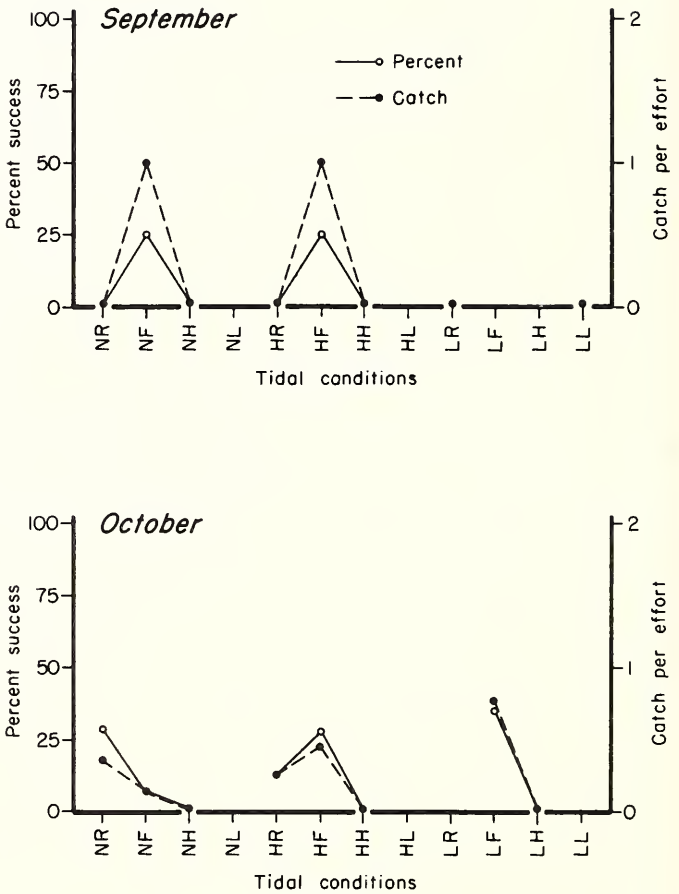
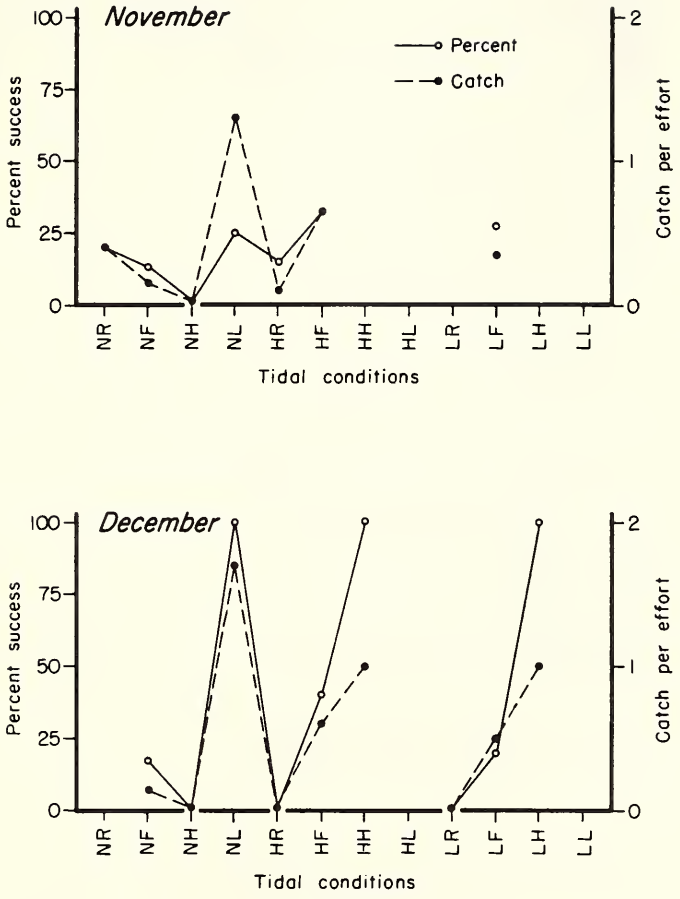


Figure 45. Sheepshead, continued.



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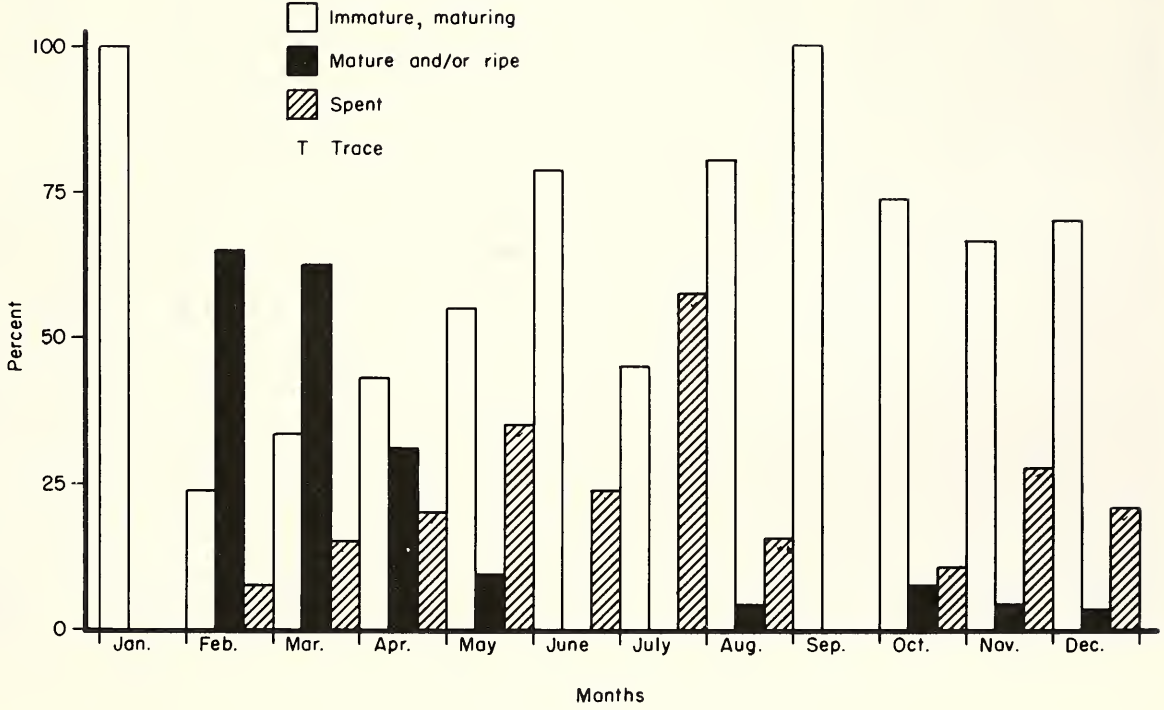

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* Denotes parts per million throughout this report.

Turbidity: Turbidities that occurred at the sampling stations during periods of sampling are shown in Table 16. The extreme low was less than 25 and the extreme high was 200. However, a turbidity reading greater than 50 was seldom observed.

Salinity and chlorinity: A discussion of salinity was previously presented in the "Description of Area" section of this report.

Chlorinities that occurred at the sampling stations during periods of sampling are shown in Table 17.

Water temperature: A discussion of water temperatures was previously presented in the "Description of Area" section of this report.

Figure 49. Trammel net catch showing relative monthly abundance of the Largescale Menhaden combining catch from all stations for the period 1960-1968.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Largescale Menhaden captured}}{\text{Total number of sets}}$$

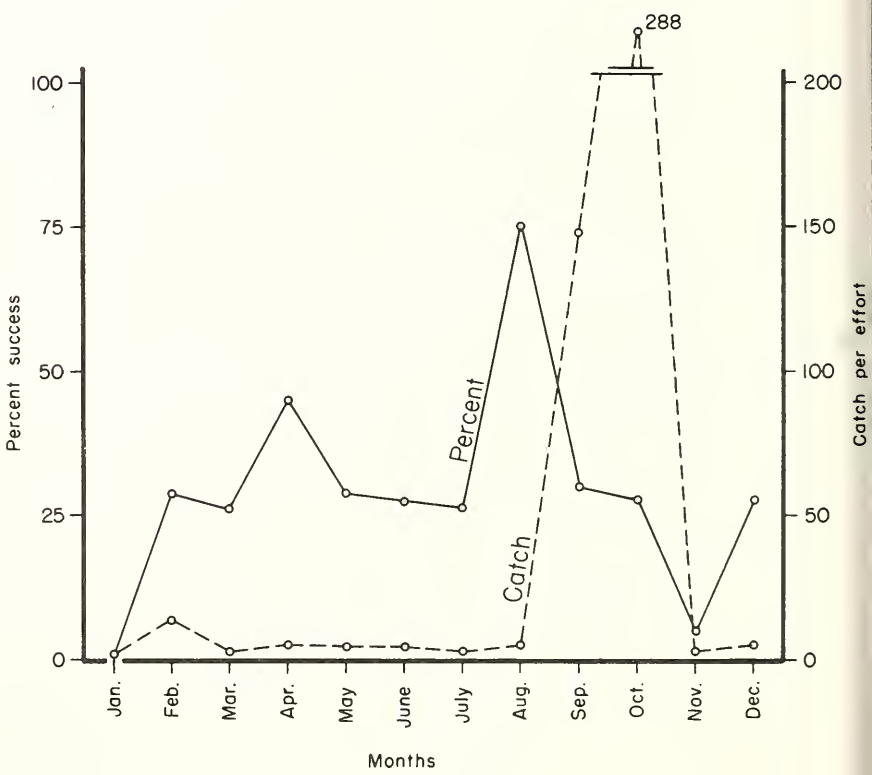

Figure 50. Trammel net catch showing relative monthly abundance of the Sea Catfish combining catch from all stations for the period 1960 - 1968.

$$\text{Percent success} = \frac{\text{Number of successful sets}}{\text{Total number of sets}} \times 100.$$

$$\text{Catch/effort} = \frac{\text{Total number Sea Catfish captured}}{\text{Total number of sets}}$$

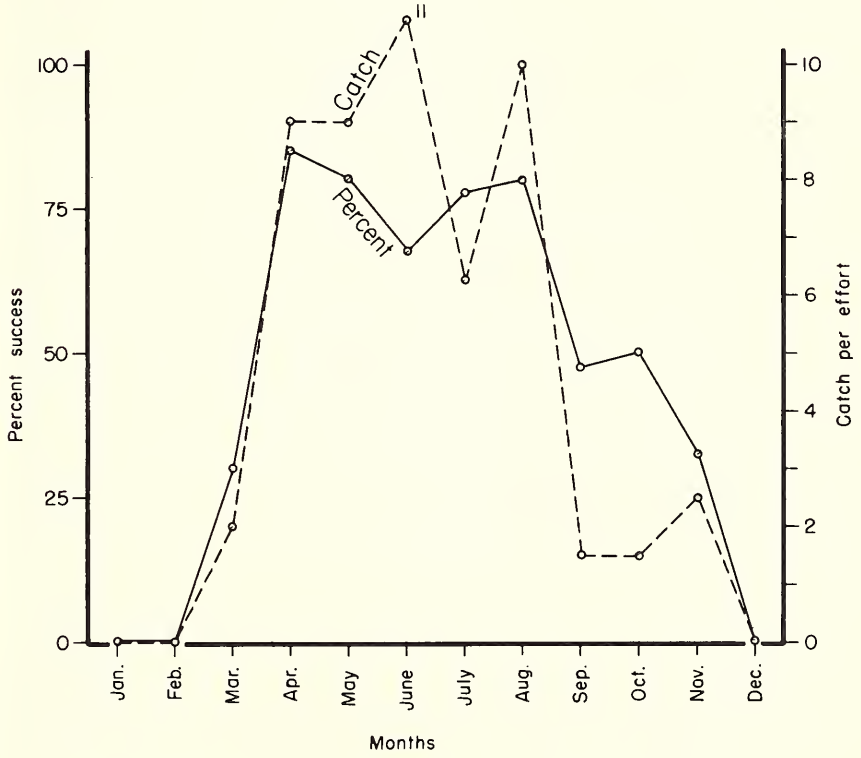

Figure 51. Monthly average and range of pH recorded combining eight years data for period July, 1960 - June, 1968.

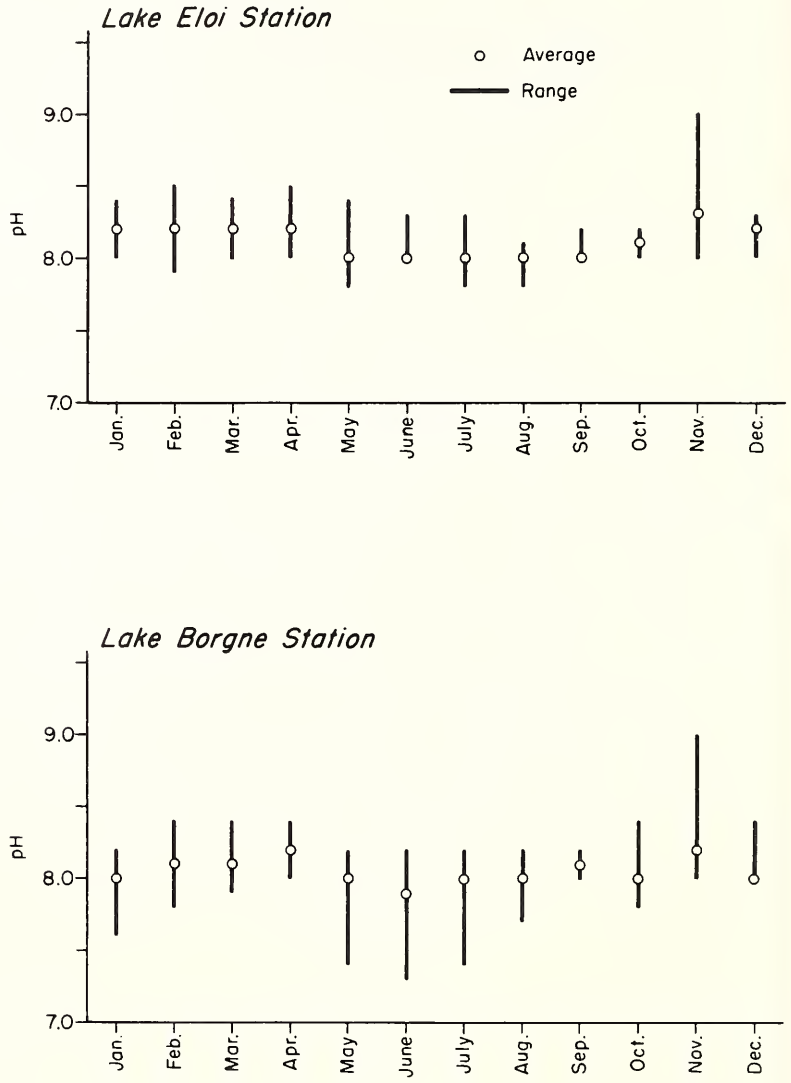

Figure 51. Monthly average and range of pH recorded combining eight years data for period July, 1960 - June, 1968.

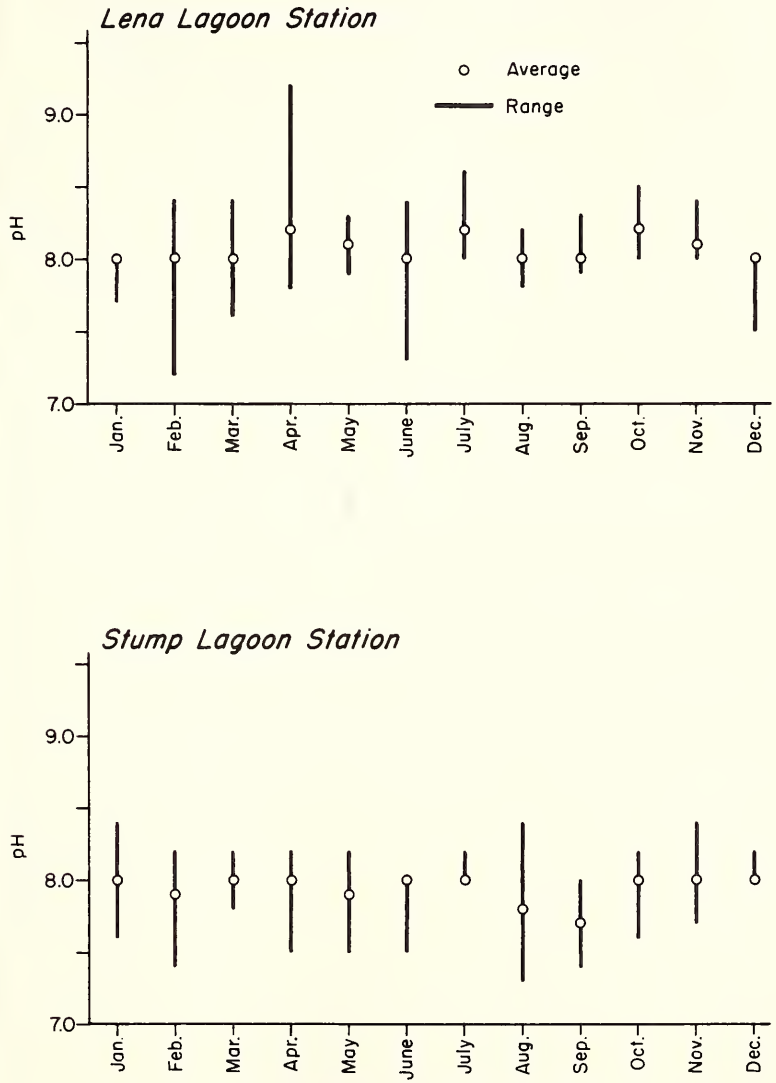

Figure 51. Monthly average and range of pH recorded combining eight years data for period July, 1960 - June, 1968.

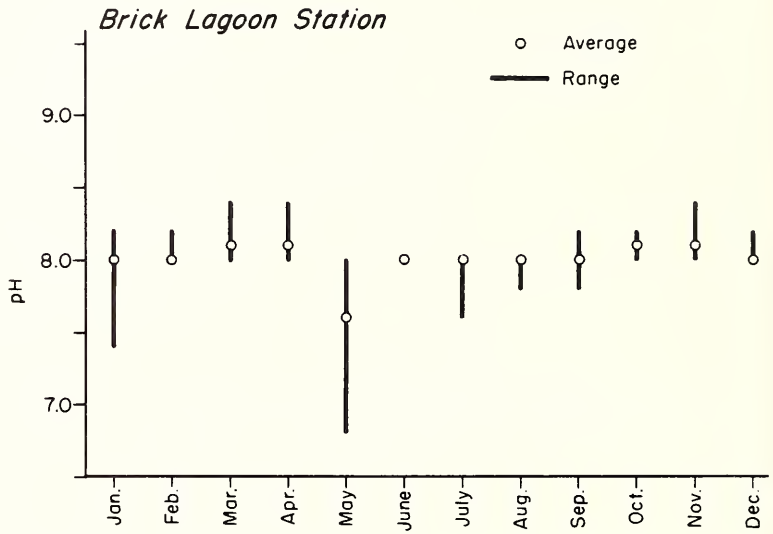

Table 10

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lena's Lagoon Station

	1960–61			*1961–62*			*1962–63*			*1963–64*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
				10	72	82	0	95	95	0	65	65
July				0	79	79						
August				0	65	65	0	75	75			
September				6	61	67	0	64	64			
				0	63	63						
October				0	195	195	0	72	72	0	70	70
November	0	42	42									
				0	62	62						
December	0	41	41									
January				0	58	58	4	55	59	0	65	65
	0	47	47	0	57	57						
February	0	58	58	0	65	65	0	63	63	0	50	50
March	0	47	47	0	68	68				0	59	59
	0	48	48	0	62	62				0	53	53
April				0	83	83				0	28	28
	6	43	43	10	99	109				0	32	32
May	0	93	93									
	12	74	86	0	64	64						
June	8	70	78	2	53	55	0	70	70			

Table 10 (cont.)

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lena's Lagoon Station

	1964–65			*1965–66*			*1966–67*			*1967–68*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
				0	99	99	0	70	70	0	82	82
July				0	145	145	0	73	73	0	88	88
August	0	50	50	0	72	72				0	79	79
							0	88	88			
September	0	57	57				0	96	96			
				0	195	195						
October	0	60	60	0	112	112	0	76	76	0	72	72
November	0	36	36	0	75	75	0	75	75	0	94	94
	0	53	53	0	63	63	0	75	75			
December	0	....	....	0	63	63	0	143	143			
										0	79	79
										0	87	87
January	0	43	43							0	94	94
				0	78	78						
February	0	40	40	0	62	62						
	0	65	65	0	74	74	6	65	65	0	107	107
March				0	75	75	0	66	66			
	0	50	50	0	65	65						
April	0	40	40	0	73	73						
	0	142	142	0	67	67	0	67	67	0	109	109
May	0	139	139							0	96	96
	0	118	118									
June							0	80	80			

Table 11

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lake Borgne Station

	1960–61			*1961–62*			*1962–63*			*1963–64*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
July				0	37	37	0	27	27	0	55	55
				0	41	41						
August				0	38	38	0	41	41			
September							6	41	47			
				0	48	48						
October							0	53	53	0	52	52
November	0	38	38	0	69	69	0	46	46			
December	10	45	55	0	53	53	0	46	46			
				0	56	56	4	48	52	0	51	51
							0	59	59			
January				0	48	48	0	53	53	0	70	70
	0	46	46	0	45	45				0	48	48
February										0	45	45
	0	40	40	0	42	42				0	54	54
March							4	48	52			
	0	43	43	0	42	42				0	19	19
April	0	39	39	0	47	47	3	49	52	0	20	20
	6	38	44	0	38	38						
May				0	33	33				0	21	21
	0	42	42	0	39	39	0	60	60			
June				0	34	34						

Table 11 (cont.)

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lake Borgne Station

	1964–65 *Alkalinity (ppm)*			*1965–66* *Alkalinity (ppm)*			*1966–67* *Alkalinity (ppm)*			*1967–68* *Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
				0	102	102	0	61	61	0	70	70
July				0	108	108	0	51	51	0	82	82
										0	72	72
August	0	50	50	0	95	95	0	64	64			
										0	68	68
										0	72	72
September	0	50	50	0	14	14	0	67	67	0	88	88
	0	50	50				0	117	117			
October	0	44	44	0	130	130	0	66	66			
November	0	52	52	0	178	178	0	83	83			
	0	48	48				0	71	71			
December	0	45	45	0	61	61	0	97	97			
				0	66	66				0	73	73
January	0	36	36	0	110	110				0	75	75
				0	80	80	0	67	67			
February	0	45	45									
	0	50	50	0	70	70	0	58	58	0	103	103
March	0	50	50	0	78	78	0	53	53			
	0	40	40	0	43	42						
April												
	0	88	88	0	54	54	0	63	63	0	103	103
May										0	82	82
	0	92	92				0	72	72			
June												

Table 12

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Stump Lagoon Station

	1960–61			*1961–62*			*1962–63*			*1963–64*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
							0	64	64			
July							0	72	72			
				0	72	72						
August				0	83	83	0	69	69			
										5	54	55
September							0	80	80	0	60	60
October				0	83	83	0	84	84			
November												
December				0	67	67						
January				6	62	68	0	65	65	1	58	58
				0	68	68						
February				0	68	68	0	49	49			
March				0	64	64				0	22	22
										0	46	46
April				0	63	63	0	64	64	0	30	30
				0	65	65						
May				0	68	68				0	38	38
										0	35	35
June				0	79	79	0	70	70	0	38	38

Table 12 (cont.)

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Stump Lagoon Station

	1964–65 *Alkalinity (ppm)*			*1965–66* *Alkalinity (ppm)*			*1966–67* *Alkalinity (ppm)*			*1967–68* *Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
				0	122	122	0	99	99	0	79	79
July				0	108	108						
August	0	50	50	0	95	95	0	71	71	0	75	75
September	0	50	50	0	14	14	0	93	93	0	89	89
	0	50	50									
October	0	44	44	0	130	130	0	82	82	0	77	77
November	0	52	52	0	178	178	0	88	88	0	96	96
	0	48	48									
December	0	45	45	0	61	61						
					66	66	0	150	150	0	98	98
January	0	36	36	0	110	110	0	133	133			
February	0	45	45	0	80	80				0	105	105
	0	50	50	0	71	71						
March	0	50	50	0	98	98	0	72	72	0	103	103
April	0	40	40	0	43	43	0	72	72			
										0	104	104
May	0	88	88	0	54	54				0	98	98
June	0	92	92									

Table 13

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Brick Lagoon Station

	1960–61			*1961–62*			*1962–63*			*1963–64*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
July										0	65	65
August												
September												
October												
November												
December												
January										0	65	65
February										0	59	59
March										0	44	44
April										0	27	27
										0	16	16
May										0	33	33
June												

Table 13 (cont.)

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Brick Lagoon Station

	1964–65			*1965–66*			*1966–67*			*1967–68*		
	Alkalinity (ppm)			*Alkalinity (ppm)*			*Alkalinity (ppm)*			*Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
				0	148	148						
July				0	158	158				0	68	68
										0	82	82
August				0	101	101	0	66	66	0	78	78
	0	36	36									
September	0	29	29	0	23	23	0	80	80			
October	....	80	....	0	213	213	0	77	77	0	76	76
	0	44	44									
November	0	67	67	0	172	172	0	76	76			
	0	59	59	0	140	140						
December	0	50	50	0	83	83				0	106	106
							0	149	149			
January				0	75	75	0	141	141			
	0	35	35	0	64	64	0	45	45			
February												
March	0	25	25	0	66	66	0	63	63	0	112	112
	0	42	42									
April	0	39	39	0	58	58						
	0	92	92	0	50	50	0	68	68	0	80	80
May	0	67	67							0	105	105
June	0	105	105				0	91	91			

Table 14

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lake Eloi Station

	1960–61 *Alkalinity (ppm)*			*1961–62* *Alkalinity (ppm)*			*1962–63* *Alkalinity (ppm)*			*1963–64* *Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
July				2	60	62	10	74	84			
				0	75	75	8	83	91			
August				0	78	78	0	92	92			
September							6	70	76	0	39	39
October				4	75	79	0	73	73			
	0	67	67	0	82	82						
November	0	55	55				2	58	60			
December	0	94	94									
				0	63	63	8	69	77	0	34	34
January												
	0	65	65									
February				8	65	73	0	55	55	0	48	48
				0	75	75						
March	0	70	70	0	68	68				0	66	66
	0	63	63	0	72	72						
April	8	48	56							0	56	56
				0	83	83				0	30	30
May	6	69	75	0	89	89				0	36	36
	4	73	77	0	78	78						
June	4	65	69									

Table 14 (cont.)

Carbonates, Bicarbonates and Total Alkalinities Recorded During the Various Months for Period 1960-68 at the Lake Eloi Station

	1964–65 *Alkalinity (ppm)*			*1965–66* *Alkalinity (ppm)*			*1966–67* *Alkalinity (ppm)*			*1967–68* *Alkalinity (ppm)*		
	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total	CO_3	HCO_3	Total
July				0	92	92	0	90	90	0	83	83
							0	95	95			
August				0	97	97	0	83	83	0	73	73
September	0	50	50				0	105	105	0	84	84
				0	217	217						
October	0	66	66	0	223	223	0	91	91	0	125	125
	0	72	72									
November	0	67	67	0	229	229	0	93	93	0	108	108
	0	60	60									
December	0	54	54	0	83	83						
				0	106	106	0	164	164	0	95	95
January												
February	0	70	70	0	71	71						
	0	35	35	0	78	78						
	0	35	35									
March	0	60	60	0	64	64	0	74	74	0	97	97
				0	81	81						
April	0	70	70	0	73	73	0	84	84	0	107	107
	0	159	159									
May	0	95	95							0	87	87
	0	157	157				0	93	93	0	92	92
June												

Table 15

Free Carbon Dioxide (ppm) Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lake Borgne
CO_2 (ppm)

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
						4	1	15
July		1	2	6		1	1	1
		1						
August		2	1		7	3	4	4
September			0		5	12		
October		2	4	5	2	1	1	0
November	1	3	2		3	1	9	
					2		5	
December	0	2	2		2	4	4	
		3	2	4		4		1
January		2	1	9	1	3	3	0
				5				
February	1	2		5	2	4	5	
					1	2	3	
March	3	2	0	4	1	2	4	2
		1		1				
April	2	2	0	1	3	1		
		3			1			2
May	0	1		1	3		4	2
		2						
June	1	3	2		1	2	8	

Table 15 (cont)

Free Carbon Dioxide (ppm) Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lena's Lagoon
CO_2 (ppm)

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
		0				2		2
July		3	2	8		1	4	1
August		1	4		5	2		0
							5	
September		0	5		4		3	
October		4	2	8	1	4	3	3
						2		
November	2				3	4	6	2
					1		6	
December	5	2			3	5	5	
								1
January		2	0	5	2			3
	5	2				2		
February	6	6		5	1	3	3	
						5	3	
March	4	3	2	2	1	2	6	3
		2		3	1	3		
April		3		2	5	3		
	3				1			2
May	0	0		3	5	5	5	1
	5							
June	0	5	5		1			

Table 15 (cont)

Free Carbon Dioxide (ppm) Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Stump Lagoon
CO_2 (ppm)

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
		4	3					
July		6	8			7	3	5
August			11		12		1	4
				5				
September			5	5		5	10	6
					3			
					2			
October		2	5		3	1	4	3
November		3			1	9	8	3
					2	2	6	
December			2		2	5	4	
January		0	3	8		2		3
		2						
February		5	2		1			2
						2		
March		4		3	1	1	4	0
				5				
April		3	3	3	1		4	
				2				2
				3				
May		5		5	5			2
June		7	10	3	4		5	

Table 15 (cont)

Free Carbon Dioxide (ppm) Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Brick Lagoon
CO_2 (ppm)

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
						3		
July				6		5		8
						2	5	
August						1	1	
					13			
September					5	13		
October					8		7	3
					4			
November					1	3	2	
					2	3		
December					2	3		3
							5	
January				9		1	3	
February				2	1	3	3	
March				6	1	1	6	7
					2			
April				3	3	2		
					5			5
May				3	8	3	8	1
June					1	1	8	

Table 15 (cont)

Free Carbon Dioxide (ppm) Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lake Eloi
CO_2 (ppm)

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July		0	0			5	5	6
		2	0				5	
August		2	3			5	5	3
	3							
September	1		0	9	15			2
						4		
October		0	2		2	4	4	3
					5			
November		2	0		1	4	7	2
					2	3		
December	5				2	4		
January		1	0	12		1	5	3
February	4	0	2	4	1	1	2	2
					2	1		
					2			
March	2	2		3	3	1	3	
	3					3		
April	0	2		2	5	2	9	3
		2		3	5			
May	0	3	5	3	5			0
June	0	1	1		5		5	1

Table 16

Turbidities Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lake Borgne

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
						36	26	33
July		*25	25	25		29	25	67
		*25						
August		*25	25		25	25	25	*25
September			25				*25	
							*25	*25
								20
October		*25	25	25	25		*25	*25
	25							
November	*25	*25	25		25	25	25	
							*25	
December	*25	90	25		25	27	*25	
		25	25	25		35		
January		87	25	25	25	11	*25	*25
				25				
February	*25	130		25	85	122	25	
					45	91	25	
March	*25	25	25	25	35	82	25	
	*25							
April	36	*25	25	25	96			
		*25						
May	*25	*25		25	25	26	37	*25
June	*25	*25			25		25	

* Less than

Table 16 (cont)

Turbidities Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lena's Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
		*25				33	60	27
July		*25	25	25		25	29	*25
August		*25	25		26	40		*25
							25	
September		*25	25		25		25	
		*25				25		
October		*25	25	26	25	38	*25	*25
November	*25				25	25	*25	*25
					25		*25	
December	*25	*25			25		*25	
								*25
January		56	25	25	30			*25
	*25	35				25		
February	*25	*25		25	25	25	*25	
March	*25	*25	50	25	25	32	*25	
		*25		25	45			
April	*200	*25		25	45			
	*25				25			
May	*25	*25		25	25			26
	*25	*25						
June	*25	*25	25					

* Less than

Table 16 (cont)

Turbidities Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Stump Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July			25			38	52	25
August		*25	25		25			*25
				25	25			
September			25	25	25		35	*25
						39		
October		*25	25		25	45	30	25
November		*25	25		25	25	*25	
				30	30	25		
December		*25		25	25	25		
January		*25				32	25	*25
		*25						
February		*25	25	54	54			*25
March		*25		25	25	90	*25	
April		43	40	26	26		*25	
		*25		25	25			
				100	100			
May		*25		42	42			34
June		*25		25	25			

* Less than

Table 16 (cont)

Turbidities Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Brick Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
						46		
July				25		57		*25
							33	27
August						150	47	*25
					25			
September					25	38		
October					25	49	26	30
November					25	54	*25	
						25		
December					25	25		*25
							*25	
January				25			*25	*25
February				25	25		*25	
March				25	35	35	*25	48
				25				
April				25	38	96		
May				25	35	69	*25	33
June					25		*25	

* Less than

Table 16 (cont)

Turbidities Recorded During the Various Months For Period June 1960-July 1968 at Sampling Stations

Lake Eloi

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July			25			25	51	32
			25					
August			25			27	31	*25
September					25	25	26	27
						66		
October			25			32	25	30
November	*25	*25	25		25		*25	*25
						25		
December	*25	*25			25	174		
January	*25	57	25	25		50		*25
February		*25	25	25		25	*25	*25
		*25			40			
March	*25	*25		25	25		*25	
	*25					31		
April	*25	*25		25	28	46	*25	
May	44	*25		25	52			39
June		*25	25		32			

* Less than

Table 17

Chlorinities Recorded in Parts Per Million During the Various Months For Period July 1960-June 1968 at Sampling Stations

Lake Borgne

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July		2100	3800	3300	5000		3500	6600
		1800					2700	6900
August		1900	5300		10000	5000	6500	7200
September			6500		8900	3300	5000	
							5500	7200
October		300	6800	500	7700	1700	5800	7200
	3.900							
November	4.000	5100	6800			5000	6600	
						5300	7200	
December	4400	2500	6200		5500	4500	6600	
		1400	6100	2500				4200
January		400	4500	1100	4400	3300	5800	6600
February	3400	500		1100	4400	5000	4200	
					6600	5500	5800	
March	2000	900	5300	1700	3300	1700	5000	
	1800			2800				
April	1600	1200	5000	4600	3900	2500		
		1900				2200		6100
May	2000	2300		4000	3300	4600	7500	5500
		3800						
June	2300	3500	7700			3900	7200	

Table 17 (cont)

Chlorinities Recorded in Parts Per Million During the Various Months For Period July 1960-June 1968 at Sampling Stations

Lena's Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
		5900			7700		6300	9600
July		6900	14400	6600	8900		6100	10500
August		4300	8300		8300	8700		7200
September		4500	8100			4900	10200	
October		4400	10600	8900	7700	7700	6600	7700
November	4100				8300	6600	6900	6900
December	6200	2100			6100	6000	9700	
								4700
January		400	6200	5500		5000		6100
	3300	1500			7900			
February	2900	2600		6100	4400	5500	10500	
							6100	
March	1900	4700	6600	5500	7200	9000	7200	6600
		4900		6400		3900		
April	2100	6900		5000		6100		
	2100					8900		7700
May	4900	9700		5000		8900	8000	6600
		6.200						
June	6300	4.500	7700			5500		

Table 17 (cont)

Chlorinities Recorded in Parts Per Million During the Various Months For Period July 1960-June 1968 at Sampling Stations

Stump Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July			9300		10000		6900	9400
August		4.700	9800			6100		10000
September			9400	10000	7700		10200	6600
					11100		8300	
October		6000	11300		11100	8300	7700	8300
November		6100	11100		11100	8900	7700	7200
					8900	7100		
December		3500			8300	6100		
							6100	
January		2000		8900			6600	5500
February		3100	11300			3300		6300
					7200			
March		3200		7700	3600	3900	8000	6600
April		4100	9800	8900		3900	10800	
						10000		6900
May		7800		5900		8900		8000
				7700				
June		1200	13300	8900		10200		

Table 17 (cont)

Chlorinities Recorded in Parts Per Million During the Various Months For Period July 1960-June 1968 at Sampling Stations

Brick Lagoon

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July				2800	5800			3900
							4300	7200
August					5500		4700	6600
						3300		
September					9700	4700		
October					10500		6100	7500
						6700		
November					10000	5500	600	
					6600	5900		
December					8300	5300		5500
							5000	
January				1100			5500	
February				1100	4400	1700	3900	
March				1900	3800	2200	6100	4400
				2800		1900		
April				4400	3900	2200		
						5000		5300
May				2200	4400	2200	6600	6100
June						4700	7700	

Table 17 (cont)

Chlorinities Recorded in Parts Per Million During the Various Months For Period July 1960-June 1968 at Sampling Stations

Lake Eloi

	1960–61	1961–62	1962–63	1963–64	1964–65	1965–66	1966–67	1967–68
July		7200	14300		8900		5500	11600
			17100				9400	
August		7000	15200	17200	9400		5500	11600
September						12700	11100	8300
					11100			
October		5400	13700		10000	8300	8600	10200
	9600					8900		
November	16400	5200	10100		11300	8900	9700	7700
					11100	6400		
December	1700	6000			6100	7200		
January		1200	10600	13300			7200	6600
February	1000	21000	13300	8300	5600	4500	8600	5500
		4700			4400	5500		
March	1000	6200		9400	8300	6600	8600	
	4600				6100			
April	3700	5500		9400	8300	6600	11300	9400
		7900		9900		11100		
May	8200	9600	13800	15500		11100		5500
	9400							
June	8300	9000	13300			9700	13300	9400

SUMMARY

Sixty eight species of fin-fishes with representatives in thirty seven families and fourteen orders of class osteichthyes were noted and documented during this investigation of the Biloxi Marsh Complex.

Sciaenidae was the dominant family and contained the most sought-after species by sport fishermen. These prized sciaenids included the spotted seatrout, *Cynoscion nebulosus*, atlantic croaker, *Micropogan undulatus*, black drum, *Pogonias cromis* and red drum, *Sciaenops occellata.*

The spotted seatrout occurred more abundantly during fall (October) and spring (April); atlantic croaker during April through September; black drum during spring, summer and fall, and red drum during fall (October-November), winter (December-January) and early spring (March).

Catch of the spotted seatrout was generally greater during water temperature range 21°C to 30°C as compared to other ranges; atlantic croaker during range 26° to 35°C; black drum range 21°C to 30°C; and, red drum during a wide range of 11°C to 30°C.

The normal increases or decreases of salinities that occurred periodically within the Biloxi Marsh Complex appeared not to affect the catch of sciaenids significantly.

Samples of the spotted seatrout were more successful in the fall and winter when collected during prevailing high and normal tidal conditions. This held true also for the black drum during the months of March, May and September. No set pattern of success was observed for capturing atlantic croakers and red drum when comparing sampling success to the various tidal changes.

Favorite food organisms of the spotted seatrout were striped mullet, largescale menhaden, bay anchovies, gulf killfish, atlantic croakers, penaeid shrimp and juvenile blue crabs; of the atlantic croakers were Rangia clams, young blue crabs, mud crabs, penaeid shrimp and bay anchovies; of the black drum were clams (Rangia), commercial oysters, blue crabs and snake eels; and, of the red drum were primarily blue crabs and secondarily, penaeid shrimp.

Spotted seatrout weighing from 0.5 pounds to 1.5

pounds composed 65% of the population sampled and were in the 11 to 16 inch class category. Atlantic croakers weighing from 0.2 pounds to 0.5 pounds composed 90% of the population sampled and were in the 7.5 to 10.5 inch class category. Black drums weighing from less than 0.5 pounds to 1.5 pounds composed 62% of the population sampled and were in the 6 inch to 12 inch class category. Red drums weighing from 1 pound to 2.5 pounds composed 57% of the catch and were in the 14 inch to 20 inch class category.

Spotted seatrout commenced spawning in April and continued into October with heavier spawning during May through August; Atlantic croakers spawned primarily during September through November, black drum spawned primarily during March through May. The spawning period(s) was not determined for the red drum.

A discussion and summary of the resultant water chemistries are presented in the section entitled, "Water Chemistries," under "Results and Discussion."

RECOMMENDATIONS

This type survey and study of estuarine sportfishes and their environment should not be limited only to the Biloxi Marsh Complex, but should continue until the entire Louisiana coast has been examined. With this knowledge, sportfishermen throughout the Louisiana coast, will better understand the fishes they are attempting to capture, resulting in more successful fishing trips. Also to continue this project would obtain documented data concerning estuarine fishes and correlated hydrological conditions in their environment. This documented data would serve as an important tool in predicting and demonstrating future effects on these estuarine organisms due to channelization, pollution, land reclamation, and other man-made alterations taking place very rapidly in this unique estuarine environments once controlled by nature only.

Furthermore, it is recommended that this technical report F-8, be re-written and published in laymen's language and form, so that the sportsfishermen can better and more conveniently understand the information presented herein.

BIBLIOGRAPHY

American Fisheries Society. 1970. A List of Common and Scientific Names of fishes from the United States and Canada. Am. Fish. Soc., Special Publication No. 6.

American Public Health Association Inc. 1955. Standard Methods for Examination of Water and Waste Water. New York. 769 p.

CONSERVATION PLEDGE

I give my
pledge as an American
to save and faithfully to
defend from waste the
natural resources of
my country—its soil
and minerals, its
forests, waters,
and wildlife

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